

AMERICAN TECHNOLOGY TRANSFER AND SOVIET ENERGY PLANNING

HEARINGS
BEFORE THE
SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-SEVENTH CONGRESS
FIRST AND SECOND SESSIONS

DECEMBER 10, 1981: FEBRUARY 9, 1982

[No. 122]

Printed for the use of the
Committee on Science and Technology



U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON: 1982

97-461 O

H201-91

COMMITTEE ON SCIENCE AND TECHNOLOGY

DON FUQUA, Florida, *Chairman*

ROBERT A. ROE, New Jersey
GEORGE E. BROWN, Jr., California
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
MARILYN LLOYD BOUQUARD, Tennessee
JAMES J. BLANCHARD, Michigan
TIMOTHY E. WIRTH, Colorado*
DOUG WALGREN, Pennsylvania
RONNIE G. FLIPPO, Alabama
DAN GLICKMAN, Kansas
ALBERT GORE, Jr., Tennessee
ROBERT A. YOUNG, Missouri
RICHARD C. WHITE, Texas
HAROLD L. VOLKMER, Missouri
HOWARD WOLPE, Michigan
BILL NELSON, Florida
STANLEY N. LUNDINE, New York
ALLEN E. ERTEL, Pennsylvania
BOB SHAMANSKY, Ohio
RALPH M. HALL, Texas
DAVE McCURDY, Oklahoma
MERVYN M. DYMALLY, California

LARRY WINN, Jr., Kansas
BARRY M. GOLDWATER, Jr., California
HAMILTON FISH, Jr., New York
MANUEL LUJAN, New Mexico
HAROLD C. HOLLENBECK, New Jersey
ROBERT S. WALKER, Pennsylvania
EDWIN B. FORSYTHE, New Jersey
WILLIAM CARNEY, New York
MARGARET M. HECKLER, Massachusetts
F. JAMES SENSENBRENNER, Jr.,
Wisconsin
VIN WEBER, Minnesota
JUDD GREGG, New Hampshire
RAYMOND J. McGRATH, New York
JOE SKEEN, New Mexico
CLAUDINE SCHNEIDER, Rhode Island
JIM DUNN, Michigan
BILL LOWERY, California

HAROLD P. HANSON, *Executive Director*
ROBERT C. KETCHAM, *General Counsel*
REGINA A. DAVIS, *Administrator*
GERALD E. JENES, *Minority Staff Director*

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

ALBERT GORE, Jr., Tennessee, *Chairman*
BOB SHAMANSKY, Ohio
HAROLD L. VOLKMER, Missouri
ROBERT S. WALKER, Pennsylvania
MANUEL LUJAN, Jr., New Mexico
THOMAS P. GRUMBLY, *Subcommittee Staff Director*
JAMES E. JENSEN, *Investigator*
DAVID D. CLEMENT, *Minority Counsel*

*On assignment to Budget Committee for 97th Congress.

CONTENTS

WITNESSES

	Page
December 10, 1981:	
John Gibbons, Director, Office of Technology Assessment, Washington, D.C., accompanied by Ronnie Goldberg.....	5
Dr. Thane Gustafson, the Rand Corp., Santa Monica, Calif.; and Edward Hewett, the Brookings Institution, Washington, D.C.....	26
Miriam Karr, vice president, Chase Manhattan Trade Information, Inc., Chase Manhattan Bank, New York, N.Y., accompanied by Roger G. Robinson, Eastern European Banking Division; and John Garrett, manager, business research, Gulf Oil Exploration and Production, Houston..	103
Additional material submitted for the record	132
February 9, 1982:	
Hon. Lionel H. Olmer, Under Secretary for International Trade, U.S. Department of Commerce.....	182
Hon. Ernest Johnston, Deputy Assistant Secretary for Economic and Business Affairs, U.S. Department of State; Hon. Stephen Bryen, Deputy Assistant Secretary for International Security Affairs, U.S. Department of Defense, and Hon. Bo Denysyk, Deputy Assistant Secretary for Export Administration, U.S. Department of Commerce.....	204

(III)

AMERICAN TECHNOLOGY TRANSFER AND SOVIET ENERGY PLANNING

THURSDAY, DECEMBER 10, 1981

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Washington, D.C.

The committee met, pursuant to call, at 9:40 a.m., in room 2325, Rayburn House Office Building, Hon. Albert A. Gore, Jr. (chairman of the subcommittee) presiding.

Mr. GORE. The subcommittee will come to order. I would like to welcome everyone who is here.

The debate concerning the advisability and extent of U.S. trade with the Soviet Union and other Eastern bloc countries has been a lengthy one. The Committee on Science and Technology has contributed to this debate, and the issues, I am sure, are well known to you all. Concern about technology transfer brings up old but important dilemmas of trade boycotts and the possible security risks associated with dual-use technologies.

Because the theories surrounding East-West trade had been previously laid out in such detail, it seemed to me a logical extension that someone should compile the facts on which the United States could base its various legislative and policy decisions about technology trade. Many had already asked the questions of how trade policy should impact the Soviets.

This subcommittee approached the Office of Technology Assessment with the question: Can we have a significant impact on the Soviet Union's plans in the area of energy production?

I believe that the resulting report, which you now have, represents a great step forward in that necessary compilation of hard, empirical data. The OTA focused on a single but important sector of the Soviet economy; namely, their energy development.

The report raises and begins to answer some questions which I believe are exceedingly important now, and will become more so as we calculate our global strategies for the eighties. The questions include:

First, given the debate of the last 3 years, what are the most accurate projections for Soviet energy production?

Second, what U.S. technology will the Soviets regard as important to their energy production over the next 10 years?

Third, what is the foreign availability of energy-related technology that is crucial to the Soviets?

Fourth, what position could the United States adopt with its Western allies with regard to the sale of high technology?

Concerning U.S.S.R. oil and gas, this report takes the sensible position that projecting Soviet production is difficult due to the lack of precise information. But the report also includes the revelation that the most crucial sector of Soviet energy expansion will not be oil, but gas.

In terms of special U.S. technology leverage, it isn't a new story that the Soviets could use our drilling and computer capabilities to pursue their goals. It is news, however, that our technology will apparently have only a limited impact on their plans.

For instance, the key deficiency in the Soviets' ability to build the west Siberian pipeline is large gaged pipe. As the study points out, we do not even manufacture this material.

However, the OTA points out that when U.S. equipment is preferred, the Soviets can and do attempt to manufacture it themselves, or do without it.

Perhaps the most crucial finding of the report is that the Soviets are almost always able to find what they need somewhere besides the United States.

The last question concerning the course of our future policy is the most difficult which this report begins to answer. The success or failure of the U.S.S.R.'s energy development will be one of the most basic factors in determining the world's geopolitical balance in the future. It is important that they receive commensurate attention.

As you can well see, a conclusion that we have limited political and economic leverage over Soviet energy development would change some of our operative assumptions about trade policy, particularly when it comes to boycotts and trade linkages.

The most important near term issue where U.S. policy will have to focus, of course, is the west Siberian pipeline. If in fact the Soviets are able to undertake this project without us, then it is necessary for us to review our policy options carefully.

In the longer term, if we indeed only hold limited leverage, then our trade policies and actions should not be naive. And it is important that if a trade dialog is to develop between our Western allies and the U.S.S.R., we work in concert with them to design workable safeguards, so that technology of critical strategic importance does not begin to flow to our disadvantage.

Because of the obvious importance of these findings, and the divergence they represent from conventional wisdom on the subject, we called for this hearing. Today's proceedings will give us the opportunity to hear from some noted experts in the field of international technology trade and geopolitical energy considerations, and what we had intended to do was to then discuss the report and their comments with representatives from the administration.

However, the representatives declined to testify after having had their commitments to testify forever a month. It appears their testimony would have looked a bit threadbare in light of the decisions made by the White House yesterday to license the export of heavy pipeline building equipment to the Soviet Union.

The subcommittee had frankly intended to ask some hard questions of these representatives concerning some inconsistencies in

their licensing policies and about the apparent lack of any cogent policy on technology and East-West trade.

Their choice not to appear here today begins to confirm some of our doubts since it seems that the positions they present to Congress wouldn't even keep overnight.

This is particularly distressing considering the important meeting that just took place in Bonn, where the Soviets and the Europeans concluded an agreement on the west Siberian pipeline.

We will be continuing these hearings at a later date, and we would hope by that time that the administration has been able to come up with a policy on these important issues.

Lastly, I want to offer my warm congratulations to my friend, Dr. Jack Gibbons, who heads OTA, for his usual job well done. Kudos also go to Dr. Ronnie Goldberg, who directed the study.

I would like to now call on the ranking minority member, Mr. Walker.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. Chairman, our hearing today is of particular concern since we will be looking into an issue which will be of increasing importance in the remaining years of this century.

For more than 35 years we have operated on a set of assumptions which grew out of our experience in the Second World War. We have always assumed that the United States would be able to dictate foreign policy to our allies and that they would accept our guidance without question.

In the years in which we were clearly the most powerful nation in the world those assumptions were never disproven.

However, under the last administration this Nation not only declined at a truly frightening speed, but we also lost our ability to automatically dictate our views to our allies. While they are still our allies, and we still have their support on most major issues, there is a growing feeling among smaller nations, particularly in Europe, that they must base their own foreign policy decisions on their own self-interests.

Western Europe has always been in a more critical position on energy dependence than the United States has. After all, we produce the majority of our own needs. But Western European nations depend heavily, and in some cases almost universally, on energy imports. Because of that dependence they are far more easily pressured by energy boycotts than we are.

When the Soviets announced a project to build a gas pipeline from Siberia to Western Europe, it was viewed with mistrust in this Nation, but with a certain degree of hope in Europe. After all, the Soviet need for hard Western currencies is well known, and many Western Europeans felt that the economic dependence of the Soviets on those hard currencies would not only help insure continued deliveries of Soviet gas, but would also help develop détente.

Only last week, one of our major European allies signed a contract with the Soviets for gas to be supplied through that pipeline when it reaches completion. Despite our earlier hopes to exert some control over the situation through diplomacy, it may now be advisable for this Nation to reexamine the question of how we can, or even should, assist the Soviets in energy development through the export of American technology.

For many years, it was assumed that we could heavily impact their plans through the use of trade boycotts. Now we are beginning to learn that that might not be true. We have an authoritative study from the Congressional Office of Technology Assessment which indicates that no U.S. policy of restricting Soviet access to energy technology is likely to succeed unless our allies change their present views in this matter.

More importantly, OTA has concluded that the vast majority of the Soviet energy-related imports of technology are from sources other than the United States, and that it is present Soviet policy to either do without Western technology where possible, or to develop their own domestic production capabilities to duplicate Western technology.

I am most distressed to learn that on the Siberian natural gas pipeline, the OTA points out that the only major item that the Soviets will have to purchase from the West because they cannot produce it in Russia is large-diameter pipe.

However, OTA points out that we cannot even impact their plans in this area since the pipe is also not produced in the United States.

It is my understanding that the administration is even at this very hour undertaking a close reexamination of our policies in this crucial area. We all realize that trade restrictions can and should be used where they can further our own foreign policy goals. We also realize that in a changing world we must be willing to change our policies to meet new challenges.

This area is closely tied to the administration's peace initiative. The President is attempting to use every means possible to further his campaign for reduced tension and threat levels. I hope that within a short time we will be able to hear from the administration officials who were scheduled to be with us today.

If it is possible that our efforts in seeking this study from the Office of Technology Assessment and our hearing here this morning will help the administration decide on the course of our policies over the next several years.

Mr. GORE. Thank you, Mr. Walker.

Mr. Shamansky.

Mr. SHAMANSKY. Mr. Chairman, and distinguished colleague from Pennsylvania, I have never heard such a harmonious set of opening statements and I wouldn't want to do anything to upset the harmony. I think they were both excellent statements and I think covered the field completely.

Mr. CORE. Thank you very much.

Our first witness will be Dr. John Gibbons, Director of the Office of Technology Assessment.

Dr. Gibbons, if you would come forward and Dr. Ronnie Goldberg, if you would accompany Dr. Gibbons. We are most pleased to have the two of you here.

Let me again compliment both of you on the report which is really a terrific piece of work and the comment which has been coming forth in the academic community and in the trade press is clearly stamping it as the definitive work in this area.

In an age where civilization is impelled toward greater change by developing technology, it is of ever-increasing importance that we

have the kind of expertise which has been established at the OTA to give the Congress the ability to understand and assess technology and its development and I think this report shows how well you all are fulfilling the charge the Congress has given you and without objection, the entire text of your prepared testimony will be put in the record, and we invite you to proceed as you see fit.

STATEMENT OF JOHN GIBBONS, DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT, WASHINGTON, D.C., ACCOMPANIED BY RONNIE GOLDBERG

Mr. GIBBONS. Thank you, Mr. Chairman.

Dr. Goldberg and I are pleased to be with the committee this morning to present a summary of the findings of our study on technology and Soviet energy availability.

Mr. GIBBONS. In order to allow time for questions, I would propose to limit my remarks to a summary of the major points that are raised in our report, Mr. Chairman.

The report is, in some respects, a sequel to OTA's assessment on technology and East-West trade which was published about 2 years ago.

Among the conclusions of that work was the point that the United States enjoys significant technological advantages over the Soviet Union in petroleum equipment and in computers. This fact has caused many observers to believe that these technologies might offer the U.S. opportunities to use export controls for purposes of exercising political leverage over the Soviet Union.

The present study addresses the question of the significance of American petroleum equipment and technology to the Soviet Union and the resulting options for U.S. policy.

The scope of this assessment is far broader. It examines the problems and opportunities that confront the Soviet Union in its oil, gas, coal, nuclear and electric power industries. In discussing the prospects for these industries in the next 10 years, the study identifies the equipment and technology most important to the Soviet Union in these areas.

It evaluates the extent to which the United States is a sole or preferred supplier of such items and it analyzes the implications for both the Soviet bloc and the Western alliance of either providing or withholding Western equipment and technology.

I would like to discuss four issues before you this morning. These are, first, the prospects for Soviet energy availability in the decade of the eighties. Second, the extent to which Western equipment and technology has assisted this production in the past and could continue to do so in the future.

Third, the role of the United States in such equipment and technology trade and, finally, the range of policy options that are open to the United States with respect to Soviet energy availability.

First, the prospects for Soviet primary energy availability.

Contrary to common belief, oil is not the key to Soviet energy performance in this decade. The relevant question is not how much oil the U.S.S.R. can produce by 1985 or by 1990, but how much energy they can produce. It is therefore important to consider pro-

duction prospects in each energy sector as well as the prospects for energy conservation in the Soviet Union.

Predictions for Soviet oil production in this decade have spanned, as you know, an enormous range. It turns out that these predictions are all based on different interpretations of fragmentary Soviet data, different subjective evaluations of Soviet oil industry practice, and different judgments about the future of the Soviet economy and its capabilities.

OTA believes that such forecasting or prediction is a highly tenuous exercise and that it is not useful to attempt to determine which, if any, of these predictions is correct. We hardly know how to predict our own future, much less that of the Soviet Union.

But to the extent that plausible outcomes can be identified, the Soviets' own goal of a small rise in oil output by 1985 is reasonable. On the other hand, even the relatively modest coal production targets for 1985 seem to us to be excessively optimistic.

The Soviet coal industry is beset by a number of problems which must be addressed simultaneously if production is to increase significantly. These problems include low labor productivity, lagging additions to mine capacity, insufficient quality and quantity of mining equipment, insufficient coal transport capacity and inability to use low-quality Siberian coals, which are now making up an increasing share of production.

Because the quality of much new coal is so low, that is the Btu's per ton, the quantity of coal mined could actually increase at the same time as the total energy derived from that coal is decreasing.

In fact, production figures for the first 9 months of 1981 show that coal production is continuing to decline in absolute terms as well.

The U.S.S.R. is committed to an ambitious nuclear program and nuclear power production there has increased greatly over the past 5 years. But OTA believes that while Soviet targets for installed nuclear capacity are attainable in principle, these probably are also overly optimistic.

The constraint here is not the lack of technical know-how, but the efficiency and production capacity of equipment manufacturers within the Soviet Union. The critical variable for the success of the Soviet nuclear program will be the ability of their support industries to construct nuclear power stations and reactors, and other equipment manufacturers to deliver sufficient quantities on time.

One alternative, of course, to greater energy production is the reduction of demand through conservation. Conservation should be an extremely promising area for the Soviet Union as it is for the United States, but despite evidence of interest in conservation and of real gains in certain industrial sectors, emphasis to date has been on producing, not saving energy.

Technically, there are major opportunities for energy savings in the Soviet Union but rigidities in the economic system have prevented Soviet policymakers from taking full advantage of them.

This situation may be ameliorated somewhat by economic reforms scheduled for 1982 which include higher energy prices, but OTA does not believe it is very likely that these will result in large gains during the next decade.

Now, given these difficulties, gains in total energy production will have to come from gas. Proven Soviet gas reserves may be likened to the oil reserves of Saudi Arabia. They are enormous. This is the energy sector with the best prospects and performance record, and Soviet planners have accorded it a very high investment priority. Targeted gains in gas output could more than compensate both in energy value and in hard currency earnings for slowing growth in oil production.

The extent to which the U.S.S.R. can capitalize on its tremendous gas potential will depend on its ability to substitute gas for oil in both its domestic consumption as well as in its exports.

The rate of construction of new pipelines is obviously the most important determinant of the extent to which Soviet gas can be utilized.

Second, Mr. Chairman, I would speak to the role of Western energy equipment and technology. There is no question that Soviet energy exploration and production have been assisted by American and other Western technology and equipment, although the impact of this assistance is impossible to quantify.

Such assistance has been almost entirely confined to the oil and gas sectors. Two years ago, which is the last year for which we could obtain complete data, the Soviet Union devoted approximately 22 percent of its trade with major Western trading partners to energy related items. The vast majority of these purchases, about 2.7 million out of a total of 3.4 million was destined for Soviet oil and gas industries.

In fact, the Soviets are virtually self-sufficient in coal, nuclear and electric power technology and equipment. Purchases in the latter areas, have been small and spotty and they appear to have been intended to compensate for very specific deficiencies in the quantity or quality of domestic equipment rather than to acquire new technological know-how.

In oil and gas development, Western imports have helped to compensate for shortfalls in the production of Soviet equipment and also for the fact that the quality of domestic equipment is usually inferior to that which can be obtained in the West.

But the impact of Western assistance has been lessened by at least two important factors.

First of all, whether for lack of hard currency, a lack of perceived need, or the fear of dependence on the West, the U.S.S.R. has never imported massive amounts of oilfield equipment.

Secondly, imported equipment and technology are usually less productive in the Soviet Union than the same equipment would be in Western nations. This is probably due to a combination of factors:

The U.S.S.R. has not often allowed hands-on training by Western firms to be carried out in the field in the Soviet Union, and companies themselves may be unwilling to meet Soviet conditions for the supply of spare parts or maintenance or training services. In addition, Soviet maintenance and production practices are often not conducive to prolonging the useful life and promoting the efficiency of imported equipment.

Now, these points are illustrated by two cases of American equipment and technology sales which are often cited as evidence of the

great impact of the United States on Soviet oil production: Electric submersible pumps and drill bits.

In the former case, we found that although the United States is the only free-world supplier of high-capacity electric submersible pumps, and although such pumps are superior to those that are produced in the Soviet Union, it is a mistake to conclude that the Soviet Union is dependent on that equipment.

The U.S.S.R. purchased about 1,500 of these pumps from us between 1974 and 1978, but none have been imported since 1978 and there is good reason to believe that the original shipments are probably now out of commission.

This point suggests that the Soviets are now supplying their own needs and/or they are using other methods of removing fluid from the oil wells.

Similarly, the United States is the predominant producer of drill bits in the West, but the Soviet Union itself manufactures these bits in prodigious quantities and has never purchased bits in large quantities from any Western nation.

A great deal of publicity has accompanied the sale by Dresser Industries of a tungsten carbide journal bearing bit plant to the U.S.S.R. The export license for this plant was recently revoked, but all the technology related to the production machinery and the manufacturing processes and the metallurgical specifications had already been transferred to the Soviets.

This revocation has so far mainly prevented Dresser from providing on-sight training once the plant is completed by Soviet workers and technicians. The U.S.S.R., therefore, has been forced to resort to trial and error to duplicate the Dresser-achieved quality. Past Soviet performance suggests that this will be difficult and time-consuming.

The single area in which Soviet energy equipment and technology purchases might be described as both crucial and massive is large-diameter pipe—as you pointed out earlier this morning, Mr. Chairman—and other equipment such as compressor stations and pipe-laying equipment for the construction of gas pipelines. There is no evidence that reliance on the West here will lessen in the present decade. Indeed, given the crucial importance of increased gas production and gas exports to the short- and medium-term Soviet energy future, such dependence is bound to increase—not only to the Soviet energy future, but also to the Soviet economic future.

There is no doubt that the Soviet petroleum industry would benefit from continued and, in fact, increased infusion of Western equipment and technology but the expenditures of hard currency and the extent of the hands-on Western involvement necessary to make such imports maximally effective would be unprecedented Soviet behavior. With the exception of gas pipeline construction there is little evidence that the U.S.S.R. is ready to make such changes.

Third, Mr. Chairman, I would like to discuss the so-called foreign availability issue.

It is important to distinguish between the contributions of United States and other Western suppliers of energy equipment and technology.

OTA's investigation of the attitudes of Japanese and selected Western European business and policy communities suggests that there is little if any predisposition among our allies to control sales of energy technology and equipment to the Soviet Union.

The Export Administration Act of 1979 stipulates that decisions regarding the control of U.S. equipment and technology be affected by the availability of similar or equivalent items in other countries.

It is left to the Department of Commerce to establish the capacity to gather and assess the information upon which determination of so-called availability will be made.

In our opinion, there remain serious conceptual and practical problems that must be resolved before foreign availability can become a viable criterion for export licensing decisions.

To the best of our knowledge, these problems have yet to be taken up in a comprehensive or systematic manner anywhere in the U.S. Government. There is no commonly accepted definition of foreign availability, no central repository of information and no system for gathering such information in a comprehensive or continuing way.

OTA's own judgments of the foreign availability of items of energy-related technology and equipment must therefore be understood to be highly generalized. The term, as it was used in our study, denotes the existence in Western Europe and/or Japan of items with similar technical parameters and capabilities as those available from firms in the United States.

The United States is not the predominant supplier of most petroleum-related items now imported by the U.S.S.R. OTA identified numerous foreign firms which supply oil and gas equipment to the Soviet Union. Technology developed in the United States is quickly diffused throughout the world through an extensive network of subsidiaries, affiliates, and licenses.

There are a few items of oil and gas equipment and technology that are solely available from the United States and a few others for which the United States is generally considered to be a preferred supplier compared to anyone else in the world.

With the exception of advanced computers, however, the U.S.S.R. is not purchasing these items; is on its way to acquire the capacity to produce them themselves; or it has demonstrated that they are not essential to its energy production needs.

The United States continues to represent the ultimate in quality for some equipment but the extent of that lead is diminishing over time and the U.S.S.R. can and does obtain most of what it needs for continuing development of its oil and gas from outside the United States.

This is particularly true of the most important imports for this decade, that is large-diameter pipe and pipeline laying equipment. The Soviet Union procures these items, as you know, from Japan, West Germany, Italy, and France.

Fourth, the implications for U.S. policy.

I would like to conclude my presentation this morning with a brief discussion of the implications of these findings for U.S. policy concerning Soviet energy.

Now, these can be categorized around four alternative policy strategies: First, a policy of trade embargo would seek to severely

curtail or even eliminate the ability of U.S. firms to sell energy-related equipment and technology to the Soviet Union, especially for oil and gas.

OTA found that in order to have a significant effect on Soviet energy production, the United States would have to be joined by its allies in Western Europe and Japan to pursue such a policy. This would require a drastic shift of the perspective of allied nations regarding their own interests in East-West trade.

It is possible to posit circumstances under which the United States might persuade its allies to reverse their existing policies but this would likely take a dramatic change in international political climate as well as a major policy initiative on the part of the United States.

A second perspective or strategy is exemplified by present U.S. policy toward trade with the U.S.S.R. which is best described as a linkage policy; that is, one that seeks to use the prospect of expansion or curtailment of trade as a carrot or a stick to exact policy from the trading partner.

OTA could find no unambiguous evidence regarding the effects, if any, that linkage has ever had on Soviet domestic or foreign policy. For this reason, no determination of its success or failure can be made.

In the case of petroleum equipment and technology the effectiveness of a linkage policy is limited by the fact that the United States is the sole supplier of very few items crucial to the Soviet oil and gas industries. And in those cases where it is a preferred supplier, alternatives are readily available to the Soviet Union.

The limitations of legislation in this case are best illustrated by the fact that the most important import for Soviet energy development in this decade, large diameter pipe, is not even produced here.

A linkage policy by itself, therefore, would probably have more symbolic than practical utility. For such a policy to have a significant impact on Soviet energy production in the decade of the eighties, our allies in Western Europe and Japan would have to pursue a similar coordinated strategy.

These nations have traditionally been reluctant to embrace linkage. Moreover, our studies showed that West Germany, France, Italy, and Japan have both economic and political reasons for perceiving that a degree of energy cooperation with the Soviet Union is in their best interest.

Thus, as in the case of a trade embargo, the United States would encounter great difficulty in orchestrating a common linkage posture toward Soviet energy development.

A third policy would be an attempt to assist the U.S.S.R. in maximizing its energy production. Here our findings suggest that for United States and other Western exports to make more of a difference, not only would the United States have to be willing to sell a lot of equipment and technology to the Soviet Union on attractive terms probably involving export credits, but the U.S.S.R. itself would have to be willing to purchase in large amounts, utilize its purchase in a more efficient manner, and allow fuller Western participation in Soviet energy projects.

Finally, the United States could formulate its policy from a purely commercial perspective, seeking to reap whatever economic benefits might be gained from selling nonmilitarily relevant items to the Soviet Union.

Such a policy might allow significant sales for individual firms, but unless it were accompanied by the extension of official export credits it is highly unlikely that it would result in enough trade to have a direct impact on the overall competitive position of the United States in world markets.

Such a policy would be more effective if it were accompanied by greater predictability in the export licensing process.

Mr. Chairman, that completes my summary. Dr. Goldberg or I would be pleased to answer any questions.

[The prepared statement of Dr. Gibbons follows:]

TESTIMONY OF DR. JOHN H. GIBBONS, DIRECTOR
OFFICE OF TECHNOLOGY ASSESSMENT
BEFORE THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
DECEMBER 10, 1981
TECHNOLOGY AND SOVIET ENERGY AVAILABILITY

Mr. Chairman,

I am pleased to present to you and the Subcommittee OTA's new Report on Technology and Soviet Energy Availability. I am accompanied this morning by Dr. Ronnie Goldberg, who directed this study.

In order to allow ample time for your questions, I propose to limit my remarks to a summary of the major points raised in our Report that should be of particular interest to the Subcommittee. An extended discussion of these and other issues appears in the summary of the Report, which I have appended to my testimony for the record.

This report is in some respects a sequel to OTA's assessment of Technology and East-West Trade, published in November, 1979. Among the conclusions of that work was the suggestion that the United States enjoys significant technological advantages over the U.S.S.R. in petroleum equipment and computers, a fact which has caused many observers to believe that these technologies might offer the U.S. opportunities to use export controls for purposes of exercising political leverage over the U.S.S.R. The present study thus addresses the question of the significance of American petroleum equipment and technology to the U.S.S.R. and the resulting options for U.S. policy. However, the scope of this assessment is far broader. It examines the problems and opportunities confronting the Soviet Union in its oil, gas, coal, nuclear and electric power industries. In discussing the prospects for these industries in the next ten years,

it identifies the equipment and technology most important to the U.S.S.R. in these areas; it evaluates the extent to which the U.S. is a sole or preferred supplier of such items; and it analyzes the implications for both the Soviet bloc and the Western alliance of either providing or withholding Western equipment and technology.

I would like to discuss four issues today. These are 1) the prospects for Soviet energy availability in this decade; 2) the extent to which Western equipment and technology has assisted this production in the past and could continue to do so in the future; 3) the role of the United States in such equipment and technology trade; and 4) the range of policy options open to the United States with respect to Soviet energy availability.

1. THE PROSPECTS FOR SOVIET PRIMARY ENERGY AVAILABILITY

Contrary to common belief, oil is not the key to Soviet energy performance in this decade. The relevant question is not how much oil the U.S.S.R. can produce by 1985 or 1990, but how much energy. It is therefore important to consider production prospects in each energy sector, as well as the prospects for energy conservation.

Predictions for Soviet oil production in this decade have spanned an enormous range. On examination, these predictions are all based on different interpretations of fragmentary Soviet data, different subjective evaluations of Soviet oil industry practice, and different judgments about the future of the Soviet economy and its capabilities. OTA believes that such forecasting is a highly tenuous exercise and that it is not useful to attempt to determine which, if any, of these predictions is 'correct.' But to the extent that plausible outcomes can be identified, the Soviets' own goal of a small rise in oil output by 1985 is reasonable.

On the other hand, even the relatively modest coal production targets for 1985 seem excessively optimistic. The Soviet coal industry is beset by a number of problems which must be addressed simultaneously if production is to increase meaningfully. These problems include low labor productivity, lagging additions to mine capacity,

insufficient quality and quantity of mining equipment, insufficient coal transport capacity, and inability to use low quality Siberian coals, which are making up an increasing share of production. Because the quality of much new coal is so low, the quantity of coal mined could increase at the same time as the total energy derived from it actually declined. In fact, production figures for the first nine months of 1981 show that coal production is continuing to decline in absolute terms as well.

The U.S.S.R. is committed to an ambitious nuclear program, and nuclear power production there has increased greatly in the past five years. But OTA believes that while Soviet targets for installed nuclear capacity are attainable in principle, these too are probably overly optimistic. The constraint here is not lack of know-how, but the efficiency and production capacity of equipment manufacturers. The critical variable for the success of the Soviet nuclear power program will be the ability of support industries to construct nuclear power stations and of reactor and other equipment manufacturers to deliver sufficient quantities on time.

One alternative, of course, to greater energy production is the reduction of demand through conservation. Conservation should be an extremely promising area for the U.S.S.R., but despite evidence of interest in conservation and of real gains in certain industrial sectors, emphasis to date has been on producing, not saving, energy. Technically, there are major opportunities for energy savings in the Soviet Union, but rigidities in the political and economic system have prevented Soviet policymakers from taking full advantage of them. This situation may be ameliorated somewhat by economic reforms scheduled for 1982, but OTA does not believe it is very likely that these will result in large gains during the present decade.

Given these difficulties, gains in total energy production will have to come from gas. Proven Soviet gas reserves may be likened to the oil reserves of Saudi Arabia. This is the energy sector with the best prospects and performance record, and Soviet planners have accorded it high investment priority. Targeted gains in gas output could

more than compensate — both in energy value and in hard currency earnings — for slowing growth in oil production. The extent to which the U.S.S.R. can capitalize on its tremendous gas potential will depend on its ability to substitute gas for oil in both domestic use and exports. The rate of construction of new pipelines is the most important determinant of the extent to which Soviet gas can be utilized.

2. THE ROLE OF WESTERN ENERGY EQUIPMENT AND TECHNOLOGY

There is no question that Soviet energy exploration and production has been assisted by American and other Western technology and equipment, although the impact of this assistance is impossible to quantify. Such assistance has been almost entirely confined to the oil and gas sectors. In 1979 — the last year for which complete data is available — the Soviet Union devoted approximately 22 percent of its trade with its major Western trading partners (some \$3.4 billion) to energy-related items. The vast majority of these purchases — about \$2.7 billion — was destined for Soviet oil and gas industries. The U.S.S.R. has been virtually self-sufficient in coal, nuclear, and electric power technology and equipment. Purchases in these areas have been small and spotty and appear to have been intended to compensate for specific deficiencies in the quantity or quality of domestic equipment, rather than to acquire new technological know-how.

In oil and gas development, Western imports have helped to compensate for shortfalls in the production of Soviet equipment, and for the fact that the quality of domestic equipment is usually inferior to that which can be obtained in the West.

But it is also true that the impact of Western assistance has been lessened by at least two important factors. First, whether for lack of hard currency, a lack of perceived need, or fear of dependence on the West, the U.S.S.R. has never imported massive amounts of oilfield equipment. Second, imported equipment and technology is usually less productive in the Soviet Union than it would be in Western nations. This is probably due to a combination of factors. The U.S.S.R. has not often allowed hands-on

training by Western firms to be carried out in the field, and companies themselves may be unwilling to meet Soviet conditions for the supply of spare parts, maintenance, or training services. In addition, Soviet maintenance and production practices are often not conducive to prolonging the useful life and promoting the efficiency of imported equipment.

These points are illustrated by two cases of American equipment and technology sales which are often cited as evidence of the great impact of the U.S. on Soviet oil production — electric submersible pumps and drill bits. In the former case, OTA found that although the U.S. is the only free world supplier of high capacity electric submersible pumps, and although such pumps are superior to those produced in the U.S.S.R., it would be a mistake to conclude that the Soviet Union is 'dependent' on this equipment. The U.S.S.R. purchased about 1,500 pumps from the U.S. between 1974 and 1978, but none have been imported since, and there is good reason to believe that the original shipments are by now out of commission. This suggests that the Soviets are now supplying their own needs and/or using other methods of removing fluid from oil wells.

Similarly, the United States is the predominant producer of drill bits in the West, but the Soviet Union itself manufactures these in prodigious quantities, and has never purchased bits in large quantities from any Western nation. A great deal of publicity has accompanied the sale by Dresser Industries of a tungsten carbide journal bearing bit plant to the U.S.S.R. The export license for this plant was recently revoked, but all the technology relating to production machinery, manufacturing processes and metallurgical specifications had already been transferred. The revocation has so far mainly prevented Dresser from providing onsite training once the plant is completed by Soviet workers and technicians. The U.S.S.R. has therefore been forced to resort to trial and error to duplicate Dresser-achieved quality. Past Soviet performance suggests that this will be a difficult and time-consuming process.

The single area in which Soviet energy equipment and technology purchases might

be described as both crucial and massive is large diameter pipe and other equipment (compressor stations and pipelaying equipment) for the construction and operation of gas pipelines. There is no evidence that reliance on the West here will lessen in the present decade. Indeed, given the crucial importance of increased gas production and gas exports to the short-and medium-term Soviet energy future, such dependence is bound to increase.

There is no doubt that the Soviet petroleum industry would benefit from continued -- and increased -- infusion of Western equipment and technology. But the expenditures of hard currency and the extent of the hands-on Western involvement necessary to make such imports maximally effective would be unprecedented Soviet behavior. With the exception of gas pipeline construction, there is little evidence that the U.S.S.R. is ready to make such changes.

3. THE ROLE OF THE U.S. IN SOVIET ENERGY DEVELOPMENT: 'FOREIGN AVAILABILITY'

It is important to distinguish between the contributions of U.S. and other Western energy equipment and technology suppliers. This distinction has particular policy relevance in light of the fact that OTA's investigation of the attitudes of Japanese and selected West European business and policy communities suggests that there is little if any predisposition among our allies to control sales of energy technology and equipment to the Soviet Union.

The Export Administration Act of 1979 stipulates that decisions regarding the control of U.S. equipment and technology be affected by the availability of similar or equivalent items in other countries. It is left to the Department of Commerce to establish the capacity to gather and assess the information upon which determination of 'foreign availability' will be made. In our opinion, there remain serious conceptual and practical problems that must be resolved before foreign availability can become a viable criterion for export licensing decisions. To the best of our knowledge, these problems have yet to be taken up in a comprehensive or systematic manner anywhere in

the U.S. government.

There is no commonly accepted definition of foreign availability, no central repository of information, and no system for gathering such information in a comprehensive and continuing fashion. OTA's own judgments of the foreign availability of items of energy-related technology and equipment must therefore be understood to be highly generalized. The term as it was used in our study denotes the existence in Western Europe and/or Japan of items with similar technical parameters and capabilities as those available from firms in the United States.

The United States is not the predominant supplier of most petroleum-related items imported by the U.S.S.R. OTA has identified numerous foreign firms which supply oil and gas equipment to the Soviet Union, reinforcing the reality of the international nature of the petroleum industry. Technology developed in the U.S. is quickly diffused throughout the world through an extensive network of subsidiaries, affiliates, and licensees.

There are a few items of oil and gas equipment and technology that are solely available from the United States, and a few others for which the U.S. is generally considered a preferred supplier. With the exception of advanced computers, however, the U.S.S.R. is either not purchasing these items, is on its way to acquiring the capacity to produce them itself, or has demonstrated that they are not essential to it.

The United States continues to represent the ultimate in quality for some equipment, but the extent of that lead is diminishing, and the U.S.S.R. can and does obtain most of what it needs for continued development of its oil and gas resources from outside the United States. This is particularly true of the most important imports for this decade — large diameter pipe and pipeline equipment. The Soviet Union procures these items from Japan, West Germany, Italy, and France.

4. IMPLICATIONS FOR U.S. POLICY

I would like to conclude with a brief discussion about the implications of these

findings for U.S. policy. Suggestions for U.S. policy concerning Soviet energy development can be categorized around four alternative strategies.

1. A policy of trade embargo would seek to severely curtail or eliminate the ability of U.S. firms to sell energy-related (especially oil and gas) equipment and technology to the U.S.S.R. OTA found that in order to have a significant effect on Soviet energy production, the United States would have to be joined by its allies in Western Europe and Japan in pursuing such a policy. This would require a drastic shift in the perspectives of Allied nations regarding their own interests in East-West trade. It is possible to posit circumstances under which the U.S. could persuade its allies to reverse their existing policies, but this would likely take a dramatic change in the international political climate, as well as a major policy initiative on the part of the United States.

2. Present U.S. policy toward trade with the U.S.S.R. is best described as a linkage policy, i.e. one that seeks to use the prospect of expansion or curtailment of trade as a carrot or stick to exact policy concessions from the trading partner. OTA could find no unambiguous evidence regarding the effects, if any, that linkage has ever had on Soviet domestic or foreign policies. For this reason, no determination of its success or failure can be made. In the case of petroleum equipment and technology, the effectiveness of a linkage policy would be limited by the fact that the U.S. is the sole supplier of very few items crucial to the Soviet oil and gas industries, and in those cases where it is a preferred supplier, alternatives are available to the Soviet Union. The limitations of linkage in this case are best illustrated by the fact that the import most important to Soviet energy development in this decade — large diameter pipe — is not produced in the United States.

A linkage policy pursued by the U.S. alone, therefore, would probably have more symbolic than practical utility. For such a policy to have a significant impact on Soviet energy production in this decade, America's allies in Western Europe and Japan would

Mr. GORE. Thank you very much. We have a vote on the floor and with your indulgence, we will recess for approximately 8 or 9 minutes and then come back and proceed with questions.

[Recess.]

Mr. GORE. The subcommittee will come back to order.

Dr. Gibbons, Dr. Goldberg, thank you again for the excellent presentation. On page 6 of your statement, Dr. Gibbons, you say that in your opinion, there remain serious conceptual and practical problems that have to be resolved by the Commerce Department before foreign availability can become a valuable criterion for export licensing decisions and you say that to the best of your knowledge those problems have yet to be taken up in a comprehensive or systematic manner anywhere in the U.S. Government.

Certainly, the decision by the administration to withdraw its testimony and decline to appear here today would indicate that that statement is exactly right, that there are serious conceptual and practical problems that have yet to be taken up in a comprehensive or systematic manner.

I wouldn't ask you to comment on that, but I will just say that I think that it is most unfortunate that there is a state of confusion in the administration.

Perhaps in lieu of the statement we had expected to receive, we ought to just put into the record the Associated Press story of the announcement from the office of Senator Percy of Illinois yesterday about the approval of the pipelaying equipment saying to the Soviet Union.

It is my understanding that the President made the decision following a meeting with members of the Illinois delegation to grant the export license and that when the decision by the President was communicated to the Department of State, the Department of Commerce, and the Department of Defense, they no longer felt that they could deliver the prepared testimony with a straight face, because it questioned the wisdom of a decision like the one the President made yesterday.

But in all fairness, I must say that in reviewing the statements that the administration witnesses had intended to give, I noticed that they had given a good deal of attention to the OTA report which was released, when, 2 weeks ago, was it?

Dr. GOLDBERG. November 17.

Mr. GORE. November 17, when the three of us conducted a briefing on it that day. I noticed that witnesses from the administration had given a good deal of attention to that statement and they were at some pains to show how the administration's policy was congruent with the facts which you have established but, nevertheless, they were making the effort.

And I think that from a broader perspective, this incident shows that the policy analysis which OTA is supposed to do is having its desired effect on policy. You are not policymakers. You are not making choices for the Government. You are responding to the request of the Congress to provide reliable information on which we can base a more sensible policy.

Prior to the President's decision yesterday with respect to Caterpillar, our policy was to discourage such exports on the assumption that such exports would make it possible for the Soviet Union to

develop its energy resources in a way that it couldn't develop them otherwise.

You report questioned that assumption and painted a different picture of reality than the one which had informed the Departments of State, Defense, and Commerce.

What could you think will be the specific effect of the sale of pipelayers by the United States announced last night to the Soviet Union?

Mr. GIBBONS. Let me make a brief response and then turn it over to someone who knows what all the facts are instead of a few of them. I have not read the article, but I understand it has to do with the sale of perhaps 200 pipeline laying machines by Caterpillar for which the intended use is one of the Soviet gas pipelines.

This will make a significant but not major impact on Caterpillar's annual sales. Whether or not the sale is actually made to the Soviet Union, it seems to me, will depend on how well Caterpillar can compete with alternative suppliers from Japan and possibly Western Europe. I am not familiar with the details there but I am quite confident that we face some fairly tough competition for the same equipment from those other countries.

Dr. Goldberg.

Dr. GOLDBERG. I would just say that the specific effect is that Caterpillar's sales this year will be higher and those of the Japanese competitor will be lower, that Caterpillar got the sale instead of a Japanese firm.

Mr. GORE. What would you expect to be the effect on the Soviet Union's development of its energy resources?

Dr. GOLDBERG. Well, those pipelaying machines are necessary to the Soviet Union. It needs them to lay those pipelines which are crucial to its energy plans in this decade. All the evidence is that it cannot supply those needs itself.

Having said that though, there are indications that if Caterpillar did not supply that equipment, alternative suppliers in Japan could.

But to get at what I think is perhaps behind your question, if the Soviet Union could not get any pipelaying machines from the West, it would be in serious trouble with its plans to complete its pipelines in a timely and efficient manner.

Mr. GORE. So, if the United States and its allies in the OECD countries together declined to sell such equipment to the Soviet Union, it would have a serious impact on its ability to develop its energy resources and supply natural gas to Western Europe but if the United States alone decides not to supply such equipment the effect on the Soviet Union would be negligible?

Dr. GOLDBERG. Absolutely.

Mr. GORE. Now, the broader context within which this debate takes place and I invite you to respond to this, Dr. Gibbons, because I know you have paid some attention to it even if it is not, strictly speaking, a technology assessment question.

The broader context involves the geopolitical balance in Western Europe. Since the end of World War II, the United States has endeavored to provide military security for Western Europe and to assure the continued availability of energy resources to Western Europe, principally from the Middle East.

The amount of attention devoted to the Persian Gulf and the rest of the Middle East in recent years has been due in part to the United States endeavoring to assure continued access by Western Europe, not just ourselves, to the energy resources in the Middle East.

If Western Europe turns for an appreciable percentage of its energy needs to the Soviet Union, then to that extent, the geopolitical balance in Western Europe is affected. You agree so far?

Mr. GIBBONS. Yes.

Mr. GORE. The question is what do we do about that. If we expend all our efforts in the direction of an unrealistic option of denying the Soviet Union the capability to construct a pipeline which it can construct without respect to any action we take, then our efforts are wasted.

If, on the other hand, we have a clearer picture of what is possible and what is not possible, then presumably we can expend our efforts in a more useful way to convince the West Europeans to design appropriate and adequate safeguards or safeguards that are as adequate and appropriate as possible to insure against the kind of dependence which would lead to intimidation in the future.

Does that all sound reasonable to you?

Mr. GIBBONS. You are always very convincing, Mr. Chairman. I would like to respond just very briefly to your question and, if I might, also ask Dr. Goldberg to decide whether or not she would like to add something to what I have to say.

The issue we are dealing with today—namely, Soviet energy development and its relationship to Western European energy needs—is one in which the timeframe must be kept carefully in mind.

If we talk about things that we might be able to do with our allies in the nineties and beyond, then there are a number of very serious options that if we began now could have major impact by the nineties and beyond.

For example, the Soviet gas pipeline to Western Europe will have a major impact in the eighties. Gas will begin to flow by the middle of this decade. In that timeframe, there is, like it or not, precious little that we can do about the pipeline that makes sense in terms of the perspectives of our Western European allies.

So, as we think about the future, it seems to me that during the eighties we have opportunities to work with our allies through IEA and through contingency planning for various means of resilience to interruptions. But we must be realistic about the extent to which we can actually substitute some other form of energy for Soviet gas in those countries.

It is a very different picture as one looks at cooperative research and development and other activities in the decade of the nineties.

Dr. GOLDBERG. Well, all I can do is expand on that a little bit. The suggestions which apparently were taken by the administration to Western Europe were not acceptable alternatives to Soviet gas because they were all unrealistic within the timeframe.

For instance, increased exports of American coal. Aside from the fact that coal is in many uses not substitutable for gas, it will be the end of the decade before America could increase its coal exports by significantly expanding ports and harbors, et cetera.

LNG projects have very long leadtimes. Helping to develop Western European gas has very long leadtimes. Similarly, R. & D. in things like synfuels and uses of coal have very long leadtimes. These are not therefore realistic alternatives right now for the pipeline project, which we now regard as a fait accompli.

Looking ahead, the Soviets have tremendous amounts of gas. One could reasonably expect that come 1985 and thereafter, talks might begin about constructing a second string to that pipeline and raising the levels of Western European dependence on Soviet gas even higher.

If we begin now working on alternatives to Soviet gas, those could be posed as alternatives to greater levels post-1990, but only if we begin now. If we wait until that deal is about to be completed then we will be in the same position as we were this year with respect to the present pipeline.

Mr. GIBBONS. Mr. Chairman, Adlai Stevenson, the one who ran for the Presidency, said that we Americans never seem to see the handwriting on the wall until our back is up against it.

It seems to me what Dr. Goldberg is saying is that we ought to do a better job of looking at the wall before we get so close to it.

Mr. GORE. Well put. And again, that is what you all exist for, what the agency exists for and you are fulfilling the mandate.

What is the cost of the west Siberian pipeline estimated to be?

Dr. GOLDBERG. One reads estimates ranging from \$15 to \$40 billion. I believe that the \$15 billion figure is just for Western equipment orders, that is the amount of the Soviet loans for equipment and technology, and that the higher amount includes estimates of what it would actually cost in dollar equivalents for the Soviets to produce the pipeline.

The latter figures I should think is very tenuous. It is very difficult to translate Soviet costs into dollars.

It is not entirely clear, though, whether these estimates are always given for just the one string of the pipeline or if they encompass more ambitious plans than the first phase of the project.

Mr. GORE. Now, the total length of the pipeline is 3,500 miles?

Dr. GOLDBERG. About that.

Mr. GORE. We are voting today or tomorrow on the floor of the House on the Alaskan natural gas pipeline which is 4,800 miles. Either of these projects by itself would qualify as the largest construction project in the history of mankind. If both of them are undertaken simultaneously, can the world's capital markets and equipment markets and pipeline markets meet that challenge.

Dr. GOLDBERG. Mrs. Karr from Chase, I believe, can probably answer that question better than we can. I will say that our understanding is that the Alaskan pipeline would be constructed with 48-inch pipe, most of it to be produced by Canada.

The Soviet pipeline is to be produced with 56-inch pipe from West Germany and Japan and Italy.

Mr. GORE. Dr. Gibbons, I know you are anxious to avoid any conflict with the CIA's estimates back in 1977 because it is not the central focus of your report at all. But it is a natural question and I wonder if you could briefly touch on any differing assumptions in your study that leads to a somewhat different analysis.

I think the CIA is now redoing some of its work in this area but can you help clarify that question?

Mr. GIBBONS. Well, in both instances, as I mentioned in my testimony this morning, we are dealing with fragmentary information that is subject to a lot of interpretation.

I would refer you to the table 1 on page 13 of the summary of your report that includes all the numbers that we have assembled, the various forecasts. I believe it would be preferable for me to ask Dr. Goldberg to respond to your specific question, Mr. Chairman, about the differences in assumptions or the reasons we say that the CIA upper limits of production estimates seem to be much more realistic than their lower numbers.

Mr. GORE. All right.

Dr. GOLDBERG. Well, we find several specific elements in the CIA analysis that lend themselves to question. To be fair to the CIA, these are areas in which the CIA has now rethought its original work. Those are things like their evaluation of Soviet water flooding practices, or the conclusions which could be drawn from those practices or the contribution of American equipment like electric submersible pumps and the importance of that equipment.

A more general problem though, and this I think is the basic place where our analysis departed from the CIA's, is that the CIA concentrated on oil. Its emphasis on oil led to the impression that it believed that the Soviet Union itself would become a net oil importer. Later, the CIA clarified this point and said that the Soviet bloc as a whole would become a net oil importer.

We believe that one needs to look not at oil alone, but at total energy. We factor in gas and with that change of emphasis the whole terms of the debate change. Therefore we believe it is very unlikely, except under a great number of simultaneously worst case events that the bloc as a whole would be a net energy importer in this decade.

Mr. GIBBONS. I might add just briefly that you will recall that to the extent that gas becomes available for domestic use to replace oil, then the Soviets can put that same oil in pipelines to export it so that the two are intimately related and you simply can't look at one and get a clear picture of what is going to happen.

Mr. GORE. Now, the West Germans apparently intend to tie a good many homeowners and small business establishments into the west Siberian pipeline; is that correct?

Dr. GOLDBERG. There are going to be residential customers for that Soviet gas. It is very, very difficult, though, to get reliable data on exactly how much of that gas is going to be consumed by residential customers. But the answer to the question is yes, a substantial portion of it will be.

Mr. GORE. How would you minimize the degree of political pressure associated with that dependence in the residential sector which could, at some future time, be felt by a West German Government faced with the prospect of a cutoff?

Dr. GOLDBERG. Well, the way the West Germans seem to be dealing with it is to try to greatly increase their gas storage capacity, to have a stockpile in the event of such a cutoff and to work on the interconnections of the European gas grid so that gas could be moved from other uses.

Whether or not those are adequate precautions I think depends on one's judgment of the likelihood of the Soviets using the gas for political purposes. And I think in that connection it has to be said that to the best of our knowledge, the West Germans seem to feel that there is no more reason to fear Soviet manipulation of their energy supplies than there is to fear OPEC manipulation of their energy supplies.

Mr. GORE. I personally would question that assumption, but the characteristics of gas make storage extremely difficult in large volume. So, presumably, the interconnection part of the contingency planning would be more important. Would you agree with that?

Dr. GOLDBERG. Yes. And we also feel that the more the West Europeans coordinate and collaborate on their contingency plans the safer they will be.

Mr. GORE. To what extent does the hard currency need of the Soviet Union provide a counterbalance to that potential leverage if a cutoff was used as intimidation?

Dr. GOLDBERG. It provides a very significant counterbalance, but one that is not very symmetrical in terms of time. In other words, if the Soviet Union cuts off the gas the effects are almost immediately felt in Western Europe. It would take longer for the Soviets to feel the lack of hard currency.

Mr. GORE. Now, let me ask you a question that again may get to the outer boundaries of your mandate but one that I think is of critical importance. Looking, as you did, at the total availability of energy within the Soviet Union in the coming years, do you conclude that the Soviet Union's need for imported oil is significantly less than the United States was assumed prior to the completion of this study?

Mr. GIBBONS. Yes.

Mr. GORE. Now, our policy in the Middle East has been based on the assessment that it was extremely possible for the Soviet Union to move into the Middle East. One of the reasons is their view of the geopolitical balance in the world. The other reason is the ample evidence of dirty deeds in the area already being accomplished.

But a third was the feeling that the Soviet Union might have a need for that oil that would combine with the other motivations to make that prospect a real one. If the need for the oil is reduced, then our picture of that challenge changes perhaps slightly.

Do you agree with that?

Mr. GIBBONS. Again, as Dr. Goldberg pointed out, if the gas option were ignored in the Soviet Union the arguments would be much more interesting. With the gas option included, however, the whole argument is very much diluted.

Do you want to add to that?

Dr. GOLDBERG. Only to say that invading the Middle East is a rather inefficient way of getting oil if your major reason for doing so is actually to have oil flowing to the Soviet Union or to Eastern Europe. If the Soviets are having trouble producing the quality equipment they need to use in their fields at home, they presumably would have even more trouble getting the equipment to Iran or wherever and using it efficiently there.

So, I think one needs to examine very closely the assumption that it would be easy or relatively uncostly for the Soviet Union to get oil out of the Middle East should it choose to do so.

Mr. GORE. On the other hand, there are a number of internal obstacles to the Soviet Union to the full development of the gas option, correct? I mean you uncovered some serious potential obstacles, did you not?

Dr. GOLDBERG. Yes, there are internal obstacles in the Soviet Union to the development of almost anything. In fact, if those obstacles didn't exist, they would probably be doing better in their other energy sectors, and gas would not be so disproportionately important right now.

But the answer to the question is yes.

Mr. GORE. Did you want to comment on that?

Mr. GIBBONS. I can share a couple of vignettes with you about the difficulties which my colleagues just mentioned. I spoke with one individual who spoke about the common problems the Soviets are having with the United States in retraining their architects to insulate pipes, getting apartment developers who don't have to pay for their hot water to conserve it is a very difficult problem.

So, I would presume that some of the capitalist tricks, such as letting the price mechanism work, may well be used in Moscow in their 1982 pricing of energy to their apartment dwellers.

They have more difficulty in their society than we do in ours, in responding to many of these needs.

Mr. GORE. Well, one of our next witnesses will be able to address that some additional detail.

I think we have covered it pretty well.

Do you have questions?

Mr. CLEMENT. No questions, Mr. Chairman.

Mr. GORE. Again, I would like to thank you and compliment you on the report. I look forward to working with you in the future. Thank you very much for being here.

Mr. GIBBONS. Thank you, Mr. Chairman.

Mr. GORE. Our next panel, incidentally, for those who have the witness list, panel 4 is the one to which I referred to earlier and we will not be having panel 4. That is not disappearing ink at the beginning of panel 4. It is a disappearing witness.

Dr. Thane Gustafson is on panel 2 with the Rand Corp. in Santa Monica and Edward Hewett with the Brookings Institution here in Washington.

Welcome to both of you. Without objection, the hard text of your prepared statements will be put into the record, and we invite you to proceed as you wish.

Beginning with you, Dr. Gustafson, welcome.

STATEMENTS OF DR. THANE GUSTAFSON, THE RAND CORP., SANTA MONICA, CALIF.; AND EDWARD HEWETT, THE BROOKINGS INSTITUTION, WASHINGTON, D.C.

Dr. GUSTAFSON. Thank you, Mr. Chairman and since my prepared statement is a part of the record, I will not read from it and what I would like to do is highlight some parts of it, and to intro-

duce, perhaps, a couple of new themes in light of the subjects raised earlier this morning.

One extremely valuable point that comes out of the OTA report, and I believe this point should be stressed very hard is that the Soviet energy problem, although it has very significant technology components is not primarily a technology problem but is a problem of building infrastructure and maintaining quality.

And what this requires from the Soviets above all is massive investment and sound management.

These two requirements, rather than technology per se, will determine whether the Soviets are able to make their program go. Now, here we have to distinguish between the short term and the long term as time goes by and we begin to talk about the horizon of the year 2000.

The technology component becomes progressively more and more important. As the Soviets need to modernize secondary and tertiary recovery, as they need techniques for exploration, for reasons of that kind, the technology component will become more important, but for the next 10 years, and to still a great extent for the next 20, capital requirements and management requirements will be uppermost.

Let me enlarge on that by saying that the single most important requirement in capital is affected by the fact that the Soviets are now extremely short of capital. The rate of increase of Soviet centralized investment is dropping dramatically with successive 5-year plans. The latest 5-year plan, the 11th, which runs from 1981 to 1985, shows yet another drop in the rate of increase of capital investment.

Now, in part, this is a deliberate policy on the part of the Soviet leaders for reasons that I can come back to if it is useful, but the implication for the energy program is that the Soviets are planning a terrific increase in capital investment in the energy program while, at the same time, slowing down the rate of increase in capital investments and the economy as a whole.

In fact, if you perform a small extrapolation exercise to see what the energy program as announced would require, you come to the conclusion that the energy program very reasonably might take up the entire increment for the next 5 years of the capital increment available for all of Soviet industry.

Now, this brings us to an interesting political question. Is it reasonable to think that the Soviet leadership is going to be willing to devote the entire increment of capital available for industrial investment to energy alone? This assumes, for example, that increases to the military sector are slowed down.

We don't know the answer to that and the data that Soviets have given us so far are very spotty and don't allow us to make more than very crude guesses about what may be happening, but I think it is entirely possible that for internal political reasons the Soviets will fail to invest as much capital in the energy sector as their own goals would seem to require.

So what we have here is not merely a problem of capital but, in fact, of coherent political decisionmaking behind the success or failure of the Soviet energy program in the next 5 or 10 years.

This is true also in the area of management. Let me take an example in the key province involved, the 'Tiumen' Province in west Siberia where the main oil and gas resources are both located.

Up until now the highest priority activity in the region has been oil which is largely concentrated the southern part of the Province. Shifting the priority of development to gas means essentially shifting the focus of activity in that Province to the north, where the infrastructure is poor.

Now, the construction organizations in Tiumen' Province do both gas and oil. They belong to a ministry that does both gas and oil and Soviet commentators are, themselves, quite frank in saying that local Province officials are having a hard time getting the oil construction people to drop oil and go north and work on gas instead.

So, when we talk about political coherence, we are not talking about just the will to allocate capital in Moscow which may be in doubt, but also the will to reallocate people and resources and infrastructure in Tiumen' Province at the local level.

That is also in doubt. I will stop there on the matter of the political state, but I want to, with those few examples, to call attention to the fact that we have a very interesting story that goes beyond foreign affairs and beyond technology to the most essential thing required for Soviet success, which is coherent political will.

Turning to the matter of the West Europeans, I think it is very interesting to stress that the West Europeans have shown their willingness to cooperate with some 69 of the essential American concerns.

And here I would like to mention as an example the decision of the French or should I say it is not yet a decision, but rather the inclination of the French to deny the Soviets the computerized control equipment that would be required for the Urengoi gas pipeline.

What this seems to show is that the Europeans are taking a double position in their reaction to the U.S. concerns. They are saying, "We don't agree with you that the interest of the West requires noncooperation with the Soviets in gas development, but we do agree with you in the essential purposes for which Comecon exists and in the essential purpose of the 1979 Export Administration Act, which is to maintain and safeguard military leadtimes by withholding essential technologies."

If the French stick to their positions on computerized control equipment next December at the meeting of the Joint Commission with the Soviets in Moscow, I think the administration can derive some comfort from the fact that the Europeans are showing a determination to cooperate with at least our most essential policy concerns in this area.

I would like to add two points that were not in my prepared statement and, Mr. Chairman, if I may, I would like to enter into the record at this point an article in international security of mine that will be coming out shortly on an important aspect of the East-West energy relationship that has not been touched upon so far which is the effect of it on Eastern Europe.

[The article referred to follows:]

Energy and the Soviet Bloc

Thane Gustafson

What are the implications of Soviet energy problems for Soviet-American relations? American minds, when first confronted with that question four years ago,¹ understandably leapt first to the Persian Gulf. Now more recent reports appear somewhat less alarming, and so we have a change for more leisurely reflection.² The Soviet energy problem is more, after all, than simply a shortage of oil; the other major Soviet energy sources are a concern too (each in its own way). It is more than a crisis of production; issues of consumption, distribution, and substitution of fuels are key elements also. And it is more than a simple problem of penury; for in a couple of decades the Soviet Union *could* have the most securely abundant energy resources of any major industrial power—if it pays the price, that is, in scarce capital, hard currency, and forgone alternatives.³ In short, the Soviet energy problem is likely to be a

An early version of this paper was prepared for the Conference on Energy and National Security, National Defense University, November 5, 1980, and will appear in a volume to be published by the National Defense University Press. The opinions expressed herein are those of the author alone.

Thane Gustafson is on the research staff of the Rand Corporation. From 1974 to 1980, he was assistant and associate professor of government at Harvard University. He is the author of *Reform in Soviet Politics* (Cambridge University Press, 1981), and *Selling the Russians the Rope? Soviet Technological Innovation and US Export Controls* (Rand, 1981).

1. The chief catalyst for the debate has been the series of reports issued by the National Foreign Assessment Center of the Central Intelligence Agency, *Prospects for Soviet Oil Production*, ER 77-10270, April 1977, and *Prospects for Soviet Oil Production: a Supplemental Analysis*, ER 77-10425, July 1977. For more recent discussions by CIA analysts, see J. Richard Lee and James Lecky, "Soviet Oil Developments," in U.S. Congress, Joint Economic Committee, *Soviet Economy in a Time of Change*, Volume 1 (Washington, D.C.: USGPO, 1979), pp. 581-600; and Joseph A. Licari, "Linkages between Soviet Energy and Growth Prospects for the 1980's" (Paper presented at the 1981 NATO Economics Directorate Colloquium, Brussels, April 8-10, 1981).

2. The implications of the most recent CIA estimates are discussed in an article by Bernard Gwertzman, "CIA Revises Estimate, Sees Soviet as Oil-Independent through 1980's," *New York Times*, May 19, 1981, p. 1.

3. For recent figures on Soviet performance in the energy field, see Theodore Shabad's News Notes in the April 1980 and April 1981 issues of *Soviet Geography: Review and Translation*, pp. 241-252. For more comprehensive background, see Leslie Dienes and Theodore Shabad, *The Soviet Energy System: Resource Use and Policies* (New York: John Wiley and Sons, 1979). Additional information and analysis will be found in Robert W. Campbell, "Energy in the USSR to the Year 2000," one of a group of essays presented at Airlie House in October 1980 and currently being prepared for publication.

major factor in most of the Soviet Union's foreign relations until the end of the century.

But will energy add a fundamentally new element to them? Will the traditional issues of Soviet-American relations be dramatically changed by new dangers and opportunities arising from Soviet energy problems?

The aim of this article is to apply these questions to a region that has been for 35 years one of the central concerns in Soviet-American relations; Eastern Europe. Let us first briefly review the overall situation. Over the last decade, four trends stand out in the Soviet Union's relationship with its East European client states and the West Europeans beyond: 1) a rapid growth in foreign trade, both in absolute terms and as a share of Soviet economic activity; 2) a striking increase in Soviet military presence and power in Europe, against a backdrop of deteriorating economic performance at home; 3) a growing Soviet effort to manage its relations with its East European clients by subsidy and economic cooperation rather than by direct pressure; and finally, 4) a normalization of post-war borders in Eastern Europe and a policy of *détente* between East and West, which the Soviet Union strives to maintain with Western Europe even while its relations with the United States are cooling. How will Soviet energy problems affect these trends in the decade ahead?

First, on the role of energy in the growth of Soviet foreign trade, the Soviet energy problem is in several respects the mirror image of America's own. The Soviets do not import energy, they export it; and they do not compete with their allies for energy; they supply them. It is largely because of its surplus of oil and gas that the Soviet Union has been able to expand its foreign trade as it has. In 1978, energy exports accounted for 64 percent of all Soviet hard-currency earnings, and over the next two years that share grew larger still, even as the actual volume of Soviet oil exported declined.⁴

This situation sounds enviable, but the Soviets depend on its continuation. The income from hard-currency energy sales, which neared \$10 billion in 1980 and could go higher still in the next few years, pays for a rapidly growing volume of imports of technology and grain. In the first half of the 1970s, about 15 percent of all newly installed equipment in the Soviet Union came from imports, and in some industries (automotive, chemical, agro-

4. Friedemann Müller, "Die Ost-West Beziehungen im Energiebereich: zwischen Abhängigkeit und Verflechtung," (Ebenhausen: Stiftung Wissenschaft und Politik, Forschungsinstitut für Internationale Politik und Sicherheit, 1980).

chemical, machine tools) the foreign contribution has been spectacular.⁵ During the 1980s large amounts of hard currency will be required to expand and modernize the Soviet energy sector itself. In other words, energy is not merely a part of the growing internationalization of the Soviet economy; it is the essential center of it.

At the same time, the USSR has become an essential source of energy for its East European clients and allies. In addition to the 1.22 million barrels a day delivered to the West in 1979, the Soviets sold 1.55 million barrels a day to Eastern Europe and 0.35 million to other communist allies.⁶

How then might the Soviets react if their present oil surplus disappeared? Would they cut off supplies to Eastern Europe? Forgo hard-currency earnings and reserve their oil production for domestic consumption? Or on the contrary, would they cut back the latter in order to maintain their exports and their commitments? At various times in the past, the Soviets have done all three,⁷ but under very different circumstances from the present.

HARD CURRENCY IN SOVIET PRIORITIES

In earlier years oil was not as important in the Soviets' own energy balance as it is today and cutting back internal consumption now would be painful. But cutting out exports would be even more painful, because since the days of Stalin and Khrushchev, the Soviets' involvement in foreign trade has gone farther than ever before. In the last two decades, the Soviets have allowed themselves to depend on unstable world markets to a surprising extent, even for such key commodities as grain and bauxite. When confronted with the American grain embargo of 1980, the Soviets did not retreat but developed other suppliers, accepting the short-term cost but apparently not changing their basic policy of preserving their livestock with foreign feed. The same has been true of Soviet high-technology imports. Disappointed in 1975 by American restrictions on credits and disagreeable controversies over export licenses, the Soviets turned instead toward West European and Japanese suppliers, but did not retreat from their policy of importing Western technology to the extent that they could afford it, even allowing an important

5. A. I. Bel'chuk, *Novyi etap ekonomicheskogo sotrudnichestva SSSR s razvityimi kapitalisticheskimi stranami* (Moscow: "Nauka," 1978, p. 7).

6. OER Conference on Soviet Oil, Reston, Va., September 4-5, 1980.

7. For a brief review of the history of Soviet trade in energy, see Marshall I. Goldman, *The Enigma of Soviet Petroleum* (London: George Allen and Unwin, 1980), pp. 57-87.

part of their chemical industry,⁸ for example, to depend on Western contractors. Consequently, even though the Soviets have endured what they undoubtedly consider some unpleasant medicine in dealing with the capitalist economies—as Stalin would have warned them they would—they have not been deterred. The Soviets are apparently in the world economy to stay.⁹

One particularly important reason why hard-currency income has been vital to Soviet leaders is that it has been one of the few means available to the Soviets of making fast starts in new policies without having to endure a laborious internal reallocation of resources and skills. One need only think of recent Soviet efforts to increase livestock, automobile production, synthetic fibers, and advanced plastics, etc., to appreciate the extra margin for maneuver the availability of hard currency has afforded. The fact that Soviet leaders have persevered in difficult international markets to make these purchases indicates how important they have become. Consequently, if Soviet oil output were to decline, one can sooner visualize the Soviet leaders making cuts in fuel allocations at home than cancelling their energy exports to the West, especially at the prices tomorrow's oil is likely to command.

ENERGY DEPENDENCE AND SOVIET CONTROL OF EASTERN EUROPE

The Soviets may be equally unwilling to cut their commitments to their East European clients. An earlier generation of Soviet leaders, faced with the choice between endangering their own growth to supply oil to their client states and risking upheaval by cutting them off, would most likely not have hesitated to choose the latter. But if the restraint that Moscow has shown in Poland so far continues, it may imply that the Soviet Union is willing to pay a considerable price to continue the style of control in Eastern Europe that has developed in the last decade. The essential condition upon which that policy rests, however, is an uninterrupted supply of oil and gas.

Soviet energy problems, then, interact strongly with these trends. As for the second—that of a steady increase in Soviet conventional military presence and power in Europe, against a backdrop of deteriorating economic performance at home—Soviet energy penury in the next two decades cannot help but add powerfully to the growing strain between military and economic

8. Philip Hanson, "Soviet Strategies and Policy Implementation in the Import of Chemical Technology from the West, 1958-78 (Pasadena, California: California Seminar on International Security and Foreign Policy, 1980).

9. For further discussion see Edward A. Hewett, "The Foreign Sector in the Soviet Economy: Developments since 1960 and Possibilities to 2000." (Discussion paper prepared for the Conference on the Soviet Economy Toward the Year 2000, Airlie House, October 1980.)

objectives in Soviet resource allocation. So close has been the community of outlooks between Party and military leaders under Brezhnev that we have become unaccustomed to internal battles in the Kremlin over defense budgets. But they have occurred in the past, and if Brezhnev's speech at the October 1980 plenum of the Central Committee is any harbinger, they will occur again in the future.¹⁰ The tradeoffs between military investment and investment in the energy sector are stark. To cite one striking example: The high-quality steel that is reserved for high-priority military uses is not available to make strong drill pipe. Consequently, the Soviet oil industry has been obliged to resort to drilling technologies that do not require top-grade steels; that in turn imposes limits on the depth and speed of their drilling.¹¹ It is thus possible that the conjunction of a succession and unprecedented need for investment in the energy sector will put on the Politburo's agenda the question of the relative priority to give to military procurement. The choice is not between guns and butter, exactly, but between two different definitions of the prerequisites for national strength and between two different time horizons by which such a goal, balanced against other Soviet goals, can be achieved.

Finally, Soviet energy problems affect the third recent trend in Soviet dealings with the West, namely, the Soviet effort to continue détente with Western Europe through expanded commercial relations and technical cooperation. The assistance of the West Europeans is an important factor in the efforts of the Soviet Union to modernize and expand energy output, especially natural gas. But the future of that relationship depends on a continuation of Soviet energy exports to the West, both as an immediate source of hard currency to pay for Western technology and equipment, and as a longer-range inducement to encourage Western European governments and banks to extend credit on attractive terms for such large buy-back deals

10. In that speech, which was remarkable overall for its emphasis on the importance of the consumer sector as the main priority for the Eleventh Five-Year Plan, Brezhnev referred three times to the military industries. Each time, he called for greater involvement by them in the production of consumer durables, agricultural machinery, and civilian machinery generally. Whereas one might have expected such calls to be balanced by ritual references to the importance of military preparedness and might, there were none. To be sure, this is not the first time that a five-year plan has opened with brave words about strengthening the consumer sector. Even so, the tone of the speech suggested that the military industries will come under strong pressure from the Party leadership to reorient a portion of their resources to civilian investment. See L.I. Brezhnev, *Kommunist*, No. 16, 1980, pp. 4-11.

11. See Arthur A. Meyerhoff, "Soviet Petroleum: History, Technology, Geology, Reserves, Potential, and Policy" (discussion paper prepared for the Association of American Geographers Project on Soviet Natural Resources in the World Economy, June 1980).

as the Yamburg gas pipeline. Any interruption or sharp cut in Soviet exports might put doubts in the minds of the Western Europeans about the Soviets' reliability as an energy supplier, thereby endangering one of the principal elements of the Soviet strategy for expanding and transforming their energy sector.

What, then, are the implications of Soviet energy problems for Soviet-American relations? Soviet energy problems do *not* add a fundamentally new element to Soviet foreign relations nor, most likely, to the basic issues of the Soviet-American relationship. But energy *does* have the potential to reinforce or to weaken the four principal trends that have characterized Soviet dealings with Eastern and Western Europe in recent years, depending on how serious oil problems turn out to be and how the Soviet leaders choose to react to them. The resulting picture is further complicated by the fact that developments in all four facets of the problem—foreign trade, military and civilian consumer demands, relations with Eastern European clients, and U.S.-Soviet relations—will react with one another. For example, a decision to maintain energy exports at all costs to both Western and Eastern Europe, while strengthening commercial relationships with Western Europe, would sharpen the competition between near-term military and longer-term economic ends in Soviet domestic politics. On the other hand, cutting oil exports to Eastern Europe, if it caused economic disruption and increased the chances of social and political unrest there, would endanger détente with Western Europe and might add in its own way to competition between civilian and military programs in the Soviet Union.

In these complex calculations, it is clear that Eastern Europe figures prominently. Are there dangers or opportunities here for American diplomacy? We turn now to a closer look at the energy problems of the six client states of Eastern Europe.

CMEA Energy Policy and Its Prospects in the 1980s

During the post-war period, when most of the economies of the industrial world were shifting from coal to liquid fuels (a movement that the Soviet Union followed with about a ten-year lag), the Eastern European economies (except for Romania, endowed until recently with abundant oil) remained centered on coal. Even today, the reliance of the Northern Tier countries on coal remains very high: In 1977 the share of coal was above 70 percent in the energy budgets of Poland and the German Democratic Republic, and above 60 percent in Czechoslovakia. For the six-country region as a whole, includ-

ing Romania, the share of coal was 57 percent.¹² However, the quality of the coal mined in Eastern Europe is diminishing steadily.¹³ Eastern Europe's share of hard coal, which, with the exception of Poland, was never very great, is declining in favor of brown coal and lignite, inferior fuels not only in their calorific content but in their handling properties and, above all, in their expense.¹⁴ Even Romania, the only East European client-state with significant oil resources, is now obliged to turn to poor-quality brown coal (1700–2300 kcal/kg.) to generate a small but growing fraction of its electricity.¹⁵

The deteriorating quality of the region's coal resources (and the rapid exhaustion of Romania's oil) leaves Eastern Europe without any ready native substitutes. East European production of oil and gas (exclusive of Romania) amounted in 1977 to a modest 352,000 barrels/day of oil equivalent, which despite a 50 percent increase over 1970 (due mainly to development of natural gas in GDR, Hungary, and Poland) shows little promise of further growth, at least unless significant offshore deposits are discovered and developed.¹⁶ Soviet writings raise the possibility that Eastern European domestic production of energy will decline from 507 million tons of conventional fuel in 1980 to 500 million tons in 1990.¹⁷ In other words, the Eastern European client states will have to rely on imports not only for any increment in supplies, but perhaps also to compensate for an outright energy drop.

On the consumption side, the East Europeans now face the consequences of having imitated the Soviet pattern of industrialization for 35 years. As Soviet commentators themselves point out, transferring the Soviet model to Eastern Europe after World War II had the result of developing heavy industries that are demanding consumers of energy (particularly metallurgy

12. Central Intelligence Agency, National Foreign Assessment Center, *Energy Supplies in Eastern Europe: A Statistical Compilation*, Washington, D.C., ER-79-10624, December 1979).

13. *Ibid.*, p. 9.

14. A recent Soviet source, citing materials published by the CMEA Secretariat in 1976, observes that the volume of overburden that must be removed in order to mine one ton of brown coal in the GDR rose from 2.8 cubic meters in 1960 to 3.9 cubic meters in 1975, and is expected to reach 5.9 cubic meters by 1990. To produce 255 million tons of coal in 1990 will require moving 1.4 billion tons of overburden and pumping possibly as much as 2 billion cubic meters of water, an amount equivalent to over one-tenth of the entire freshwater runoff of the country. Deterioration of brown-coal resources in Czechoslovakia follows much the same pattern. See I. D. Kozlov, *Energeticheskoe khoziaistvo stran-SEV* (Moscow: "Nauka," 1980), p. 11.

15. Kozlov, p. 13.

16. CIA/NFAC 1979, *op. cit.*, p. 10.

17. Oleg Bogomolov, "Collective Quest for Solutions: The Fuel and Energy Problem in the CMEA Countries," *World Marxist Review* (August 1980), p. 49.

and chemical engineering), disregarding the fact that what the Soviet Union had the energy resources to afford the Eastern European countries did not. The illogic of this approach has been recognized within the Council for Mutual Economic Assistance (COMECON, or, as referred to hereafter, CMEA) since the middle of the 1950s, but in practice there has been little change.¹⁸ As a result, the level of energy consumption of the CMEA states per unit of GNP is even higher than that of the Soviet Union (see Table 1).

INEFFICIENT METHODS, INAPPROPRIATE MEANS

One striking manifestation of the command-economy system in Eastern Europe is the apparent unwillingness or inability of economic planners to prevent investment levels from exceeding the plan, sometimes by very wide margins.¹⁹ Consequently, partly as a result of deliberately accelerated growth policies in effect during the first half of the 1970s, and partly as the result of "above-plan" investment, the East European economies now carry a burden of need for energy and raw materials that exceeds more and more what they can meet with their own resources. At the same time, the energy sources available to them are poorly suited to modern industry.

Their response since the early 1960s has been to resort to massive imports, particularly of Soviet oil and gas. Oil imports from the Soviet Union reached 1.55 million barrels/day in 1979,²⁰ nearly double the level of 1970.²¹ In the

Table 1. Comparative Energy Consumption

	1973	1978
Soviet Union	15.1	15.8
Eastern Europe	19.2	19.3
Common Market	9.5	8.5

Ratio expressed in millions of \$/yr in GNP per barrel/day of oil equivalent consumed.

Source: Central Intelligence Agency, *Handbook of Economic Statistics*, 1980.

18. Kozlov, pp. 128-131. See also R. Vintrova, "Materialoemkost' proizvodstva v stranakh SEV," *Voprosy Ekonomiki*, No. 5, 1979, pp. 92-101.

19. Paul Marer, "The Economic Situation in Eastern Europe and Soviet Economic Policy Toward the Region," in a forthcoming Council on Foreign Relations volume on Soviet policy toward Eastern Europe, edited by Sarah M. Terry.

20. OER Conference on Soviet Oil, Reston, Va., September 4-5, 1980.

21. CIA/NFAC, *op. cit.*, p. 11.

late 1970s the six Eastern European client states depended on the Soviet Union for around 30 percent of their total energy needs, and the expectation of one Soviet writer is that the figure may rise to 50 percent by 1990.²² Even Poland and Romania, historically self-sufficient in energy, are becoming net importers. Poland alone, by the end of the century, may require annual imports of 1.4 million barrels/day of oil and 40 billion cubic meters of natural gas.²³

SOVIET SUPPLY RETRENCHMENT

In this relationship the Soviets have been ambivalent partners. Early in the 1960s, to be sure, the Soviet Union encouraged the Eastern Europeans to turn to it, apparently to prevent Western suppliers from gaining a position in their place. But by the later 1960s the Soviets had begun to take the position, which they defended firmly in CMEA debates, that oil shipments to Eastern Europe were not in the Soviet interest, because of the high opportunity cost (the East Europeans pay for their oil primarily with machinery, but not the high-technology manufacture that the Soviets could buy with the same oil in the West).²⁴ Two factors apparently contributed to this change in the Soviet position. The first was the growing Soviet awareness of the extent of the shift that was taking place in the East European fuel balance, as the East Europeans moved with alacrity to a more "modern" (i.e., oil-based) mix of fuels. Second was the premature peaking of the Volga-Urals oilfields, occurring a decade earlier than had been foreseen. (The rise of the West Siberian fields was not yet realized at that time.)²⁵ By 1974, the Soviet Union hoped to slow the growth of Eastern oil imports to 3 percent a year during the Tenth Plan (1976-1980), as opposed to the average of 10 percent annual growth that had prevailed during the Ninth Plan (1971-1975). The East European countries were informed by the Soviet Union in the early 1970s that oil deliveries in 1976-1980 would be held to the 1975 level,²⁶ which is exactly what the Soviets informed their clients in 1979. This time, however, the line they proposed to hold was that of 1980, by this time nearly one-third higher.

22. Kozlov, p. 25.

23. *Ibid.*, p. 25.

24. Marer, *op. cit.*

25. John P. Hardt, "Soviet Energy Policy in Eastern Europe," in Sarah M. Terry (ed.), *op. cit.*

26. John R. Haberstroh, "Eastern Europe: Growing Energy Problems," U.S. Congress, Joint Economic Committee, *East European Economies Post Helsinki* (Washington, D.C., USGPO, August 1977), pp. 379-395.

The phenomenal increase in Middle Eastern oil prices beginning in 1973 destroyed these expectations. It is interesting to note that the Soviet decision to disregard its self-imposed limits and ship more oil to Eastern Europe during the Tenth Plan (1976-1980) than it had initially planned to do was due in large part to the problems of Poland: initially scheduled to receive only 58 million tons of oil during the Tenth Plan, Poland benefited from an upward revision to 75 million as early as 1976 and has received even more since.²⁷ Nevertheless, despite these increases, the Soviets have managed to hold the line in one respect at least: the share of Soviet oil production exported to Eastern Europe, which had climbed from 9 percent in 1965 to 13 percent in 1975, had not increased much beyond that latter figure by 1980.²⁸

In the last two years, however, the Soviet Union has taken an increasingly tough position toward its East European clients. It has declared its firm intention to hold the line on oil exports, but more important, it does not commit itself to be the supplier of last resort. The East Europeans' energy problems, Soviet writings imply, are ultimately their own to solve.²⁹ Though the Russians plan rapid increases in shipments of gas and electricity (particularly through the Soyuz gas pipelines and the Vinnitsa-Albertirsha 750-kv transmission line, both completed during the current five-year period), the stated purpose of Soviet policy is to stabilize East European dependence on Soviet energy and gradually to move toward what Moscow regards as a sounder and broader division of roles.

CMEA NUCLEAR POWER PROGRAMS: CONTINUED SCARCITY?

Consequently, the joint CMEA energy program, as developed over the last several annual sessions of CMEA, aims at building up non-oil sources, increasing production of electricity from coal, and rationalizing consumption. The centerpiece of the program is nuclear power. The objective is to have 37 gigawatts of total nuclear capacity outside the Soviet Union by 1990. And in

27. *Ibid.*, 1977, p. 384.

28. The first two figures come from Haberstroh; the latter figure assumes Soviet oil production of 600 million tons and deliveries to Eastern Europe of 80 million tons. However, deliveries may be increased over that figure in view of the fact that Romania is importing Soviet oil for the first time, and also in view of Polish difficulties which have reportedly cut Polish coal output by 20 percent.

29. This at least is the inference to be drawn from Soviet discussions of the subject. For two representative examples, see O. Bogomolov, "Mezhdunarodnyi rynek stran SEV," *Voprosy Ekonomiki* 4-1980, pp. 113-121; A. Iakushin, "Sotrudnichestvo stran SEV v toplivno-energeticheskom komplekse," *Voprosy Ekonomiki* 6-1979, pp. 92-100.

addition, 8 gigawatts from two new stations are to be built jointly on Soviet territory, half of the output of which will be committed for export to Eastern Europe.³⁰ This will represent a ten-fold expansion of nuclear capacity over present levels, and by 1990 nuclear power is intended to provide 25 percent of the six Eastern European countries' total consumption of electricity.³¹ This, according to the plans, will replace 75 million tons of standard fuel per year.³²

The concentration of the nuclear effort is obviously different from country to country. Poland and Romania, because of their greater availability of coal and oil, respectively, have the least ambitious CMEA nuclear power programs. However, for the other CMEA countries, the share of nuclear power (as a percentage of total electrical production) is expected to be much greater; for the GDR, 30 percent by 1990; for Bulgaria, 50 percent.³³ The distribution of current and planned nuclear capacity is as shown in Table 2.

A noteworthy feature of the CMEA nuclear program is the prominent role it proposes to give to the East Europeans themselves. Here the lead role has been assigned to the Czechs, and particularly to the Skoda works, which are expected to supply reactors for the Paks (Hungary), Nord (GDR), and Iaslovsk-Bohunice (Czechoslovakia) projects in 1980 or shortly thereafter. During the decade of the 1980s, the Skoda works are scheduled to supply eight VVER-440 units to Czechoslovak powerplants and between six and ten more to stations elsewhere in Eastern Europe.³⁴ A Skoda reactor for the Paks project was shipped to Hungary in the spring of 1980.³⁵

The participation of the East Europeans is not confined to reactors, however. Each country has been assigned a role in the manufacture of different components for nuclear power: Poland will make volume compensators and heat-exchange equipment; Hungary control equipment; Bulgaria armatures and safety devices, and so forth.³⁶ However, it is important to note that even

30. F. Ia. Ovchinnikov, "Atomnoi energetike—chetvert' veka," *Teploenergetika* 7-79, pp. 2-5. Ovchinnikov is deputy minister of the Soviet Ministry of Power and Electrification, with special responsibility for nuclear power.

31. A. Iakushin, "Sotrudnichestvo stran-SEV v toplivno-energeticheskom komplekse," *Voprosy Ekonomiki* 6-1979, p. 93.

32. G. A. Shasharin and E. P. Katunov (both officials of V/O Soiuzglavzagranatomenergo), "O sotrudnichestve stran-chlenov SEV v oblasti atomnoi energetiki," *Standarty i kachestvo* 10-1979, pp. 10-11.

33. Iakushin, *op. cit.*, p. 93.

34. *Ekonomicheskoe sotrudnichestvo stran-chlenov SEV* No. 1, 1979, p. 43, cited in Kozlov, 1980, p. 89.

35. *Pravda*, May 5, 1980.

36. Shasharin and Katunov, *op. cit.*, p. 11.

Table 2. Details of CMEA Nuclear Power (as of 3/81)

Country	Project Name	Capacity (Megawatts)	Reactor Type	Beginning of Operation
Currently in Operation				
Bulgaria	Kozloduj 1,2,3	3 x 440	VVER	1974, 1979, 1980
Czechoslovakia	Jaslovska-Bohunice KS150	143	VVER	1972
	Jaslovske-Bohunice V-1 (1,2)	2 x 413	VVER	1979, 1980
German Democratic Republic	Rheinsberg-4	1 x 80	VVER	1966
	Bruno Leuschner (Nord)	4 x 440	VVER	1973-79
Currently under Construction (or undergoing tests)				
Bulgaria	Kozloduj 4	440	VVER	1981
Cuba	Cienfuegos 1,2	2 x 440	VVER	1986
Czechoslovakia	Jaslovske-Bohunice V-2	2 x 440	VVER	(construction just beginning)
	Dukovany 1,2,3,4	4 x 440	VVER	1983-1985
	Mochovice 1	1 x 440	VVER	
German Democratic Republic	Rheinsberg-2 (?)	440	VVER	
	Bruno Leuschner (Nord)	2 x 440	VVER	
	Magdeburg (Stendal)	4 x 440	VVER	(construction just beginning)
Hungary	Paks	2 x 440	VVER	1981
Poland	Zarnowiec	2 x 440	VVER	1985
Romania	Cernavoda	660	Candu	1985
Planned for Operation Before 1990:				
Bulgaria	Kozloduj 5,6,7	3 x 1000	VVER	1984-1990
Czechoslovakia	Mochovice 2,3,4	3 x 440	VVER	1986-1987
	Malovice	1000	VVER	?
German Democratic Republic	Bruno Leuschner (Nord)	2 x 440	VVER	
	Magdeburg (Stendal)	4 x 440	VVER	
		2 x 1000	VVER	
Hungary	Paks	2 x 440	VVER	1985-1986
Romania	(various locations)	5 x 660	Candu	1985-1990

Sources: *Pravda*, *ECPE*, *Financial Times*, Zheludov and Konstantinov, Kozlov.

if the Skoda works and the other East European manufacturers were to perform perfectly on schedule, the CMEA targets would still require a considerable contribution from the Soviet Union, amounting to at least a half-dozen VVER-440 reactors and probably several times that, not to mention technical advice and some skilled manpower. This will come at a time when the Soviet Union is mounting a crash nuclear power program of its own, which calls for a total nuclear capacity of 90 gigawatts in operation by 1990.³⁷ To some extent, the Soviet construction program is based on the newer VVER-1000 units and the channel-graphite reactor (RBMK), so that Eastern Europe will inherit the established production capacity for the VVER-440. Nevertheless, the critical scarcities that have slowed down the Soviet nuclear effort to date, such as shortages of skilled manpower and high-performance materials, presumably affect both the VVER-440 and the VVER-1000. It seems unavoidable, in other words, that the Soviet and East European nuclear efforts will compete with one another so strongly that the Soviets will be forced to make difficult choices between them. There is a growing shortage of electrical power, particularly peak-coverage power, in both Eastern Europe and European USSR.³⁸ Which need shall have the greater priority?

This is a pressing question, because it is already clear that the CMEA nuclear schedule is falling seriously behind schedule. As early as the fall of 1980, Czechoslovakia—the country with the most ambitious program—cut back its 1990 goal from 10,280MW to 8280, and over the winter of 1981 a further cut to 7280MW was announced.³⁹ In the spring of 1981 the German Democratic Republic also revised its nuclear targets downward, and shifted the emphasis in its new five-year plan to coal-fired electricity.⁴⁰ Hungary also reports delays, as well as cost overruns that have pushed the costs of the Paks project to date from a planned 50 million to 80 million florints.⁴¹

These delays reinforce one another, aggravating the performance of the whole. Thus Poland's economic difficulties, in addition to slowing down work at the Zarnowiec site,⁴² are likely to have repercussions on the CMEA nuclear program elsewhere, for the Poles are committed to an important role

37. I. S. Zheludov and L. V. Konstantinov, "Nuclear Power in the USSR," *International Atomic Energy Bulletin*, Volume 22, Number 2 (April 1980), pp. 34–45.

38. For references to problems with electrical power supply, see Kozlov, pp. 13, 20, 22.

39. *Energy in Countries with Planned Economies* (cited hereafter as ECPE), October 1980 and February 1981.

40. *Financial Times*, April 22, 1981.

41. ECPE, January 1981, p. 24.

42. ECPE, February 1981.

in supplying equipment for the Khmel'nitsky and Konstantinovka stations, which will be located on Soviet soil but are designed to supply electrical power to Eastern Europe. The Poles also have bilateral agreements to build nuclear powerplants jointly with the Soviets at Smolensk and Kursk.⁴³ Similar repercussions result from delays in production at the Skoda works in Czechoslovakia, upon which several East European projects, notably the Paks project in Hungary, depend.

The outlook for the second half of the 1980s is even less encouraging, since to meet its goals the CMEA program must make a transition to 1000-megawatt units, superseding the current 440-megawatt size. Yet plans involving the larger units appear soft, chiefly because the Soviets are running behind schedule in producing them.

CONSERVATION: THE UNCHARTED COURSE

As we look beyond specific energy sources to the larger question of the place of energy in East European economies, the outlook is no brighter. Conservation measures, in particular, are only now beginning to receive serious attention, and they will not significantly reduce the energy/GNP elasticity in the near future.⁴⁴ For all the space the official literature devotes to conservation and rationalization of consumption, the emphasis in practice is on increasing energy production. Yet the production side is still suffering from the after-effects of underinvestment in earlier years. In contrast to the pattern of above-plan investment in heavy industrial sectors such as mining, metallurgy, machine-building, and chemicals, the energy sector obtained a declining share of total investment from the mid-1960s until well into the early 1970s and has yet to regain the share it commanded in 1960.⁴⁵

Energy and Power as Sources of Soviet Influence

In sum, the East European energy situation has all the unfavorable features of the Soviet energy crisis and none of the favorable ones. The East Euro-

43. Dusko Doder, "Polish Events Spark Reaction in East Bloc's Interlocked Economies," *Washington Post*, April 12, 1981, p. A14. According to Doder, the Poles have pledged about \$700 million in electrical equipment, automatic instrumentation, rolled metal, and labor for the Khmel'nitsky project. In addition, a major switching station for Hungary, East Germany, and Czechoslovakia is scheduled for construction at Rzeszow in southern Poland.

44. Edward A. Hewett, "East European Energy in the 1980's," (Unpublished paper prepared for an Office of Technology Assessment project on Soviet energy and East-West technology transfer. The project's final report, to be published shortly, will be based on the supporting papers.) March 1981, pp. 69-73.

45. I. D. Kozlov, *op. cit.*, p. 12.

peans too face a crisis that has many aspects: They face decline (or only slow growth) in every one of their major energy sources; and they suffer from excessive consumption and political structural obstacles standing in the way of rapid improvement. Like the Soviet energy problem, that of the East Europeans is intractable in the near term—even more so than that of the Soviets, in fact, since they lack the hard currency or the native resources to mount a major investment effort aimed at changing their energy economy rapidly. Finally, the one element that gives the Soviets hope—the prospect of energy abundance in the longer term—is denied the East Europeans, who see continuing decline of their none-too-abundant coal reserves. Nuclear power and offshore oil are but glimmers as yet, offering no major relief before the end of the century. Instead, all the signs point to an ever-growing dependence on the Soviet Union.

Because it is difficult for the East European states to implement rapid conservation or fuel substitution, their economic growth is a hostage to their oil supply even more than it is for most other countries. An American estimate is that a 50 percent reduction in Soviet oil deliveries to Eastern Europe between 1980 and 1985 would drive the East Europeans' annual rate of growth to one percent or less, particularly in Hungary, Czechoslovakia, and the German Democratic Republic.⁴⁶ Moreover, the dependence of the East Europeans is compounded by the fact that they have nowhere to turn but to the Soviet Union, for their capacity to earn foreign exchange to buy their own oil is extremely limited, and their indebtedness to the West is high.

However much this dependence may be welcome to the Soviet Union in the abstract, it is not by any means a blessing when one gets down to the specifics. First, while Moscow has the undoubted power to plunge Eastern Europe into a depression if it curtails oil exports much below their present level, it is far from certain that along with this negative power over the East Europeans, the Soviets derive many positive sources of influence. Oil exports are an imperfect instrument for controlling and fine-tuning East European economic decisions, because the East Europeans appear to have less than perfect control over those decisions themselves, particularly in such matters as capital investment. Oil exports are also not a particularly good lever for inducing the East Europeans to contribute equipment and manpower to the Soviets' own development projects, because such contributions turn out to

46. Robin A. Watson, "The Outlook for Energy and Economic Growth in Eastern Europe," (Unpublished paper presented at the NATO Economics Directorate Colloquium, Brussels, April 8-10 1981).

be more expensive and more troublesome for the Soviets than they may be worth.⁴⁷

Worse still, the leverage the Soviets may gain by sacrificing their oil to the East Europeans does not necessarily buy them social peace or political stability there. It is thus entirely possible that, after extending themselves to supply the East Europeans with oil, gas, and electricity, the Soviets may still find themselves faced with major upheavals that require intervention. Intervention, in turn, could in addition to its other costs have the result of increasing the energy dependence of whatever country is the victim.⁴⁸ As a consequence, the Soviet leaders may have the feeling that *they* are the real hostages of the East Europeans' energy problems.

How will the Soviets react? It is most unlikely they will make a black-or-white choice between selling oil to the West and supplying their Eastern European clients, or (if the decline in Soviet oil output is serious enough) between buying oil on the world market solely for their own use and solely for their clients. Rather, they will continue to do what they are already doing: to adjust the balance between competing demands as circumstances dictate. The variables bearing on their decision will shift from year to year and therefore one should expect a series of *ad hoc* adjustments, reflecting the prices of oil, grain, and gold on world markets, the snow cover in the Ukraine and the winds in Kazakhstan, to say nothing of conditions in Eastern Europe itself.

East European Energy Problems: American Interests and Responses

Do the energy problems of the Soviet bloc add a fundamentally new element to the traditional pattern of U.S.-Soviet relations in Eastern Europe? The

47. For example, the *Financial Times* reported in the fall of 1980 that during Gosplan Chairman Nikolai Baibakov's visit to Warsaw, he told the Poles he thought the price for Polish construction work was too high (*Financial Times*, October 17, 1980). It is interesting to note that in recent Soviet articles, the joint Soyuz pipeline, which the CMEA countries built and financed jointly, receives ritual praise but without any mention of similar follow-on projects during the coming Eleventh Plan (Iakushin, *op. cit.*). A recent Canadian analysis concludes that the Soviet Union ended up shouldering a greater share of the burden than they had anticipated and consequently favor such projects rather less than they once did. (See J. B. Hannigan, "The Orenburg Natural Gas Project and Fuels-Energy Balances in Eastern Europe," Ottawa: Institute of Soviet and East European Studies, Carleton University, July 1980.) The East Europeans may participate in the Yamburg project, however.

48. In this connection, note the sharp drop in energy investment during the five-year period from 1966 to 1970, and also the recent sizable deterioration in the Polish balance of trade with the Soviet Union, as a result of labor unrest.

picture sketched in these pages suggests that the region's energy problems are so many and so intractable that they give a serious new twist to features that have long been present: the recent intravenous feeding of Soviet oil is but a continuation (if on a higher order of magnitude) of a long history of debilitating subsidy; the shortage of hard currency, which leaves the East Europeans nowhere to turn if Soviet largesse should decline, is likewise part of a larger pattern of backwardness in East European export industries, softened by decades of guaranteed outlets in the Soviet Union; the energy-intensity of East European economies is a legacy of the Soviet-style industrialization imposed after World War II.

In short, East Europe's energy problems both *reflect* and *aggravate* the long-standing weaknesses of the bloc's economic and political structure, shaking the whole edifice as it has never been shaken before.

What does this imply, in turn, for American policy? Soviet problems in Eastern Europe are not necessarily Western opportunities. If Soviet oil-export decisions consist of adjustments at the margin, then it follows that American influence on this question will necessarily be marginal also. Nevertheless, to the extent that the United States has any leverage at all, what should it aim to achieve? Three possibilities suggest themselves: 1) to try to drive a wedge in the Soviet bloc; 2) more modestly, to prevent the Soviet Union from capitalizing on the East Europeans' energy plight to expand and tighten Comecon; 3) to encourage West Europeans to enter into a closer energy relationship with the East European satellites.

TRY TO DRIVE A WEDGE IN THE SOVIET BLOC?

It is tempting to think of weakening the Soviet bloc close to home by taking advantage of its energy troubles. But how, exactly? Could the advantage be exploited or lastingly maintained? And is it really in the interest of the United States to make the attempt?

The first point to bear in mind is that the East Europeans, because of their severe economic and political problems, will not be helped by any measures short of heroic. Even if they were to ask the West for massive help, the question must be posed—what do they have to offer and what does the West have to give? It is not possible to lend the East Europeans much more than they already owe. The West is not rich enough itself in oil to take up the Russians' burden, and it has little need of the machinery that the East Europeans would use to pay for it. What *could* benefit the Comecon countries would be direct technical assistance in helping them to meet their nuclear

goals, to expand their coal production rapidly, and to expand coal-fired electrical generating capacity. But such a program—given the inability of the East Europeans to pay for it—would amount to nothing less than a Marshall Plan for Eastern Europe.⁴⁹

What lasting benefits would the West derive from such generosity? The only ones that would make the game worth the cost would have to be political and diplomatic, and there the East Europeans' margin for maneuver is very small. It is a sobering exercise to review the formidable limits to the West's influence in Eastern Europe compared to that of the Soviets: first, Western aid is dwarfed by the massive subsidies provided by the Soviet Union, which amount to over \$10 billion a year from preferential oil prices alone.⁵⁰ Consequently, the Soviet Union has more leverage over East European foreign trade and debt service than does the West. This year, for example, the West made the unpleasant discovery that Polish coal exports, already considerably reduced by the turmoil there, have gone primarily east instead of west.⁵¹

Second, we should bear in mind that, in the long run, simple geography makes the Soviet Union East Europe's most logical energy supplier. It follows that if the present phase of Soviet energy penury is followed by a later stage of relative abundance (as many Western experts believe), the Soviet Union could reassert any economic dominance it had lost in the interim. This prospect may lead the Soviets to reason that there is no harm in letting the West pour money and technology down the East European rathole, on the bet that any political gains the West may make can be easily cancelled later.

In sum, the combination of East European economic weakness and Soviet geographic proximity makes the region a risky proposition for a major Western investment, whether financial or diplomatic. To speak of using energy to drive wedges is to exaggerate the opportunities available in the region.

Are there more promising avenues available? It would be helpful to know, first of all, whether there already exist concrete examples of ways in which energy-poor countries in Eastern Europe can maintain semi-independence

49. In the case of Poland, that is what is happening even now; and as loans to Poland increasingly take on the character of foreign aid, normal commercial criteria are giving way to diplomatic ones and the role of governments is beginning to overshadow that of private banks, which in view of the enormous exposure of the latter introduces new complications all around.

50. E. Hewett, in 1981 OTA paper, *op. cit.*

51. *New York Times*, May 21, 1981. Polish coal shipments to the Soviet Union declined by 38 percent in 1980, but those to the European Economic Community dropped by 75 percent.

in spite of the overwhelming proximity of the Soviet Union. In the next section we take up the cases of Romania, Yugoslavia, and Finland.

MAINTAINING SEMI-INDEPENDENCE IN ENERGY. THREE EXAMPLES

Three countries—Finland, Romania, and Yugoslavia—have stood outside the orbit of CMEA, despite extensive commercial relations with the Soviet Union. Though they are three very different countries, they have one thing in common: in the last few years, their energy needs have been leading them to build closer ties with the Soviet Union than before. The Soviets, naturally enough, see this as an opportunity to increase the integration of CMEA and to draw the outsiders closer. However, as we shall see, Finland, Romania, and Yugoslavia have managed to blend Soviet and Western contributions in such a way as to keep Soviet leverage at a minimum.

ROMANIA, though a full member of CMEA, has kept its distance from the economic integration policy pursued by Moscow since 1971. Because its oil resources gave it independence in energy until its production peaked in 1976, and also because it is the least coal-based of the East European economies, Romania did not initially take any part in the cooperative efforts conducted by other CMEA members in oil and gas exploration, electricity transmission, emergency oil allocation (through the "Internefteprodukt" confederation, formed in 1978), and conversion to natural gas.⁵² However, with the rapid decline of its oil fields Romania now finds itself in a very different situation. In 1980, for the first time, Romanian imports of oil equalled domestic production⁵³ and the Soviet Union provided it with 1.2 million tons of oil, whereas it had never exported any oil to Romania before 1978. Presumably not coincidentally, Romania has begun to take part in a growing number of energy-oriented CMEA activities. For example, a joint program of offshore exploration, which Romania had initially declined to join when it was formed in 1972, now includes Romanian geological agencies among its members.⁵⁴ Similarly, in November 1977, Romania joined the other CMEA countries in signing a joint agreement on the development of a common electricity grid,⁵⁵ and although it was not a full partner in the construction of the Soyuz gas pipeline, Romania supplied "engineering equipment" for the project that

52. Kozlov, *op. cit.*, pp. 46, 55, 115, 122.

53. *Financial Times*, October 1980.

54. Kozlov, *op. cit.*, p. 46.

55. Kozlov, *op. cit.*, p. 53.

amounted to some \$554 million,⁵⁶ in return for which, from 1980 on, it will obtain each year 1.5 billion cubic meters of natural gas via the new system.⁵⁷ Romanians have likewise taken part in cooperative work on MHD generation, solar power, and superconducting transmission lines.⁵⁸ Symbolic though these efforts may be, they demonstrate the growing pressures on the Romanians to behave like other East European client states as their domestic energy supplies deteriorate.

YUGOSLAVIA has been an associate member of CMEA since 1964. It maintains a large and growing trade turnover with the Soviet Union, which will reach \$17 billion for the period 1976-80 (including \$5 billion for 1980 alone).⁵⁹ In the energy field, Yugoslavia has taken at least some part in the joint energy programs being promoted by the Soviet Union, particularly in nuclear power. It is a member of "Interatomenergo," the CMEA nuclear power association.⁶⁰ The Yugoslavs have also been involved in planning a unified power grid, at least to the extent of "cooperating" with it.⁶¹ Over the years, Yugoslavia has been a steady customer for Soviet power generating equipment, notably for the Dzherdap-1 hydropower station and the Obrenovats and Sisak thermal stations.⁶² Yugoslavia is also playing a role in the accelerated CMEA program for nuclear power development. The Sarajevo firm "Energoinvest," as of the summer of 1980, had shipped thirteen 290-ton steam separators for nuclear powerstations in the Soviet Union. This was Yugoslavia's first nuclear contract, but the Soviets are apparently satisfied that the necessary quality standards have been met and further orders have been placed.⁶³

Despite these growing energy ties with the Soviet Union, however, neither Romania nor Yugoslavia has adopted the Soviet VVER technology for its nuclear program. The Yugoslavs have contracted with Westinghouse to build

56. V. A. Shanina, *Transportno-ekonomicheskie svyazi stran-chlenov SEV* (Moscow: "Nauka," 1978), p. 94. Cited in Kozlov, *op. cit.*, p. 65.

57. J. B. Hannigan, *op. cit.*, p. 54. Hannigan believes that Romania decided to participate in the project only after the initial plans had been drafted.

58. Kozlov, *op. cit.*, pp. 95, 98, 99.

59. Interview with Soviet First Deputy Chairman of the Council of Ministers I. V. Arkhipov, "Po puti sotrudnichestva," *Sotsialisticheskaya Industriya*, June 24, 1980.

60. Kozlov, *op. cit.*, pp. 57, 59.

61. Kozlov, *op. cit.*, p. 94.

62. Arkhipov interview, *op. cit.*

63. A. Sergeev, "Reis do Kardelevo," *Sotsialisticheskaya Industriya*, July 8, 1980. The Paton Institute in Kiev served as technical adviser to the "Energoinvest" firm for sophisticated welding techniques.

a 664-megawatt power station at Krsko in Croatia, which should begin operation in 1981.⁶⁴ The Romanians, after abortive discussions with the Soviet Union about the possibility of installing a Soviet-made 440-megawatt reactor at Olt near Bucharest, have adopted the Canadian CANDU technology instead for a series of six 660-megawatt reactors, to be built during the 1980s. Work is already underway on the first, located near Cernavoda.⁶⁵ Since both countries plan major investments in nuclear power during the 1980s, it should be possible to continue the West's current strong role.

FINLAND is an interesting special case. Since the beginning of the 1970s, the Finns have had bilateral agreements with the Soviet Union for the construction of nuclear powerplants using Soviet technology. Two Soviet nuclear units are currently in operation in Finland (Loviisa 1 and 2, with capacities of 465 and 440 megawatts respectively) and a third one was ordered in 1974 (Loviisa 3, 1000 megawatts).⁶⁶ During the same period, Finnish imports of Soviet energy sources have grown rapidly. In 1980 the Soviet Union supplied 7 million tons of crude oil and 3 to 3.5 million tons of petroleum products and 1,050 million cubic meters of natural gas, in addition to coal, coke, electricity, and nuclear fuel. In contrast to Soviet plans for the rest of Eastern Europe, the latest Finno-Soviet trade agreement provides for an increase in Soviet oil exports during the 1980s, to perhaps as much as 8 million tons a year. Natural gas will increase to 1.4 billion cubic meters.⁶⁷

Even as their energy ties with the Soviet Union have grown, however, the Finns have been careful to diversify their sources and have adapted Soviet technology to their own requirements. The Loviisa units contain equipment from West Germany and Great Britain and are shielded by containment vessels of American design. Alongside the 600 Soviet specialists who worked at Loviisa the Finns called in technical advisers from Switzerland. And Loviisa represents only half of the Finnish nuclear program; the other half,

64. ECPE, November 1980. The government of Croatia has recently approved a 1000-megawatt facility, to be located at Prevlaka just east of Zagreb, also of Western design.

65. ECPE, October 1980. The Cernavoda station should be commissioned before the end of 1985. By the end of 1990, Romania's nuclear generating capacity could reach nearly 4000 megawatts.

66. *Ekonomicheskai gazeta*, No. 46 (November 1978).

67. *Hufvudstadsbladet* (Helsinki), December 10, 1980 (Translated in JPRS No. 77475, February 27, 1981, p. 1). The Finno-Soviet trade agreement for 1981 provides for an increase in overall trade between the two countries from 3.8 billion rubles to 4.2 billion, with a slight surplus in favor of the Finns.

consisting of two units of 691 megawatts in operation at Olkiluoto, was built by the Swedes.⁶⁸

What these cases appear to show is that, while the growing energy needs of Romania, Finland, and Yugoslavia have caused them to expand their energy ties with the Soviet Union, they have managed to keep their distance. The West can help them maintain that distance, by making sure that Romania, Yugoslavia, and Finland continue to have alternatives. But it should also be clear how different these cases are from the other East European countries, and that there is no possibility that the latter can enjoy the same degree of energy independence from the Soviet Union. All that the West can do is to help them begin to build for the future.

ENCOURAGE THE WEST EUROPEANS TO ENTER INTO CLOSER RELATIONS WITH THE EAST EUROPEAN SATELLITES?

In recent years, commercial relations between the Soviet bloc and the major West European countries have expanded rapidly. In Western Europe the Soviet Union's economic needs complement its diplomatic purposes; and even as the Soviets buy West European pipe and technology in exchange for oil and gas, they promote their conception of détente through expanded energy ties between East and West Europe.

The United States has been watching this trend with growing apprehension. The prospect of a France or a Germany dependent on the Soviet Union for between one-third and one-half of their natural gas consumption understandably makes the United States nervous, as do recent Soviet proposals for a Pan-European Energy Conference and an East-West power intertie. If the energy relationship between Western Europe and the Soviet bloc grows much closer and economic interdependence between the two becomes a fact, will not the Soviet Union gain serious diplomatic leverage over America's most important allies?

Leaving aside the question of whether economic interdependence produces usable diplomatic leverage (a belief that has not profited the West much in recent years), we should ask ourselves who will gain leverage over whom as a result of the growing East-West energy relationship. For example, the

68. For valuable information about the Finnish nuclear program, as well as an excellent analysis of East European nuclear power generally, I am grateful to Lesley Fox. See her *L'Energie Nucléaire en URSS et dans les Pays de l'Est* (Master's Thesis presented in the Department of Economic Sciences under the direction of Professor Marie Lavigne, University of Paris I, October 1980).

Soviet proposal for an East-West electrical intertie, recently revived by Minister of Power P. S. Neporozhnii at the World Energy Conference in Munich in the summer of 1980,⁶⁹ reflects serious Soviet difficulties in providing peak-coverage power in the European part of the Soviet Union, where most of the industry and population are concentrated. In the future this problem will grow worse, and the Soviets are running out of options to deal with it. In view of this situation, an East-West power intertie should be seen less as a move in a Soviet diplomatic offensive than as a partial answer to a serious domestic problem. The Soviets need such an intertie more than do the West Europeans; the West Europeans might therefore gain the greater leverage.⁷⁰ A similar argument might also apply to Soviet gas exports to Western Europe, for once a pipeline network is in place, it leaves the producer with few options as to where to export his product (by contrast to, say, an LNG facility next to a major seaport). In short, arguments about the possibly dire consequences of West European energy dependence on the Soviet Union turn out to be more complex upon closer examination.

What about the consequences of East-West energy ties for the East European client states? There is the possibility here that West European business can do what American diplomacy cannot: increase long-term Western influence in the East European client states by associating them in the overall East-West energy relationship. What if, for instance, West European engineering firms used their idle capacity to build nuclear powerplants in East Europe on a partial buy-back basis, thus speeding up the flagging CMEA nuclear program and taking pressure off the overburdened Soviet nuclear industry? What if East-West electrical interties and pipelines benefited the East European client states as well, Poland and others obtaining gas in exchange for contributing work crews to help build the Yamburg pipeline, as they did for the Orenburg? What these questions raise is the possibility of finessing the East Europeans' lack of hard currency and native energy resources to bring them in, "on the cheap" so to speak, to a larger East-West energy community. These possibilities raise serious questions for Americans to consider.

69. ECPE, October 1980.

70. For a Soviet review of internal problems in electrical power, see an article by one of the leading energy officials in Gosplan, A. Troitskii, "Elektroenergetika: problemy i perspektivy," *Planirovanie khoziaistva*, No. 2, 1979, pp. 18-25.

Washington has no quarrel with its allies over the desirability of promoting closer economic ties with the non-Soviet East European states; where agreement becomes difficult is over the matter of expanding ties with the Soviet Union itself. The question is, can one have one without the other? Such a distinction is especially hard to draw in the case of energy, since whatever help the West gives to the client states in that department directly displaces part of the Soviets' burden and consequently amounts to helping the Soviets as well. There is really no practical way to separate the two sorts of ties. But if the implications of that do not sound very good to American ears, they probably do not sound especially welcome to the Soviets either: the implicit price for obtaining badly-needed Western help with their energy problems is to accept a certain restraint in their dealings with their client states.

Conclusion

This is a time for each side to weigh its interests. The Western response depends, first of all, on the significance of recent events in Poland. Americans have been so preoccupied by the threat of a Soviet intervention there that we may not have paid enough attention to the larger fact that, intervention or no, an era may be coming to an end on the Soviets' western marches. Over the next two decades, the Soviets' own economic difficulties will constrain them in dealing with the problems of their client states. The example of Poland, even if it finally produces a violent response in this case, underscores a crucial new fact: the frozen system we have known for the last generation cannot be maintained by force at anything less than an enormous price, and the long hesitation the Soviet leaders have shown in dealing with Poland shows that they may have begun to understand that point. If the West is to take advantage of this development, one of the most important instruments will be energy.

What, after all, would we like Western influence to achieve? Our aims, if we put them realistically, can be no more than modest. As we have seen, there are, in the short term, no wedges available. It is a vain hope to think that, through Western efforts, the client states could enjoy the same energy independence *vis-à-vis* the Soviet Union as do Finland and Yugoslavia. But through energy-related aid and cooperation, the West can encourage internal reform⁷¹ and lay the basis for future relief of the region's dependence on

71. In a recent interview the deputy editor of *Polityka*, Zygmund Szeliga, voices the extraordinary thought that IMF-type intervention, as a spur to internal economic reform, would not be

Soviet energy; without these two it is not possible to speak of long-term political evolution. The odds against success are high. But if the result is a broadening of the alternatives available to East European elites, strengthening their position *vis-à-vis* their Soviet protectors while preserving the area from cataclysm, then that is an effort that the United States can only welcome.

unwelcome in some Polish governmental circles. "That would give the government here a chance to blame outside forces for unpleasant decisions," he said. *Dagens Nyheter* (Stockholm), April 13, 1981, pp. 28 and 29.

Mr. GUSTAFSON. If the Soviets sneeze in energy Eastern Europe catches cold. The East Europeans are in a particularly desperate position because of the decline in Polish coal output. The East Europeans, as you know, have the Soviets export 80 million tons of oil per year to Eastern Europe.

The future energy development of Eastern Europe rests very heavily on nuclear power development which is largely in Soviet technology and in manpower.

The nuclear program in Eastern Europe is encountering very serious difficulties. It may be that there is an opportunity here for the West to develop energy aid relations with Eastern Europe that may contribute to the loosening of the Comecon entity and contribute further to the loosening of the Soviet hold in this area.

Those are complicated questions. We can only begin to see what Polish events may lead to. Nevertheless, this is a role that the West Europeans may be able to play in Eastern Europe and it suggests that the development of an East-West energy relationship may have aspects that will be positive for American policy and for Western policy as a whole.

Mr. GORE. Without objection, the entire text of that upcoming article in *International Security* will be put in the record in full at this point, and also the study that you have done entitled, "Selling the Russians the Rope" will also be included in the record.

[The information follows:]

Selling the Russians the Rope? Soviet Technology Policy and U.S. Export Controls

Thane Gustafson

SUMMARY

Alarmed by the rapidly growing military strength of the Soviet Union, Americans wonder whether they are unwittingly contributing to it by transferring advanced technological skills and know-how to Soviet industry. The system of export controls in effect during the 1970s was criticized for allowing important technology to slip through to the Soviet bloc because it focused too much on products, and not enough on skills, techniques, and know-how. The most recent legislation, the Export Administration Act of 1979, mandates the development of a new review procedure that will control classes of so-called "critical" technologies rather than individual items. The foundations of American policy on export controls are now being rethought as part of a general rethinking of the premises of American policy toward the Soviet bloc.

The aim of this report is to take a new and critical look at the objectives and assumptions of U.S. high-technology export-control policy. An expanded system of export controls could be more complex, costly, and controversial than any we have had before. At the same time Americans remain ambivalent about the objectives of export controls and unclear about what such controls can achieve and what they cannot. Our thinking will be considerably clarified, however, if we bear in mind that the most important question about technology transfer in the long run is whether the receiving side is able to absorb the technology it imports, to diffuse it beyond one or two showcase locations, and to build upon it to generate further technological advances of its own. Only then does technology transfer have its most lasting consequences.

Accordingly, this report describes the main developments in Soviet technology policy over the last ten years, to analyze the reasons for Soviet technological lag and to extract their implications for export-control policy. Five Soviet experiments in the management of innovation stand out as especially significant: (1) full-cycle planning of especially important R&D projects by the State Committee on Science and Technology; (2) ministry-wide reform of the innovation system (first launched in the Ministry of Electrical Equipment); (3) increased investment in development and pilot-production facilities; (4) "one-roof" research and development corporations; (5) expansion of the role of the Academy of Sciences in development and pilot-production (especially in the Siberian Division and the Ukrainian Academy).

This array of new policies reflects a lengthy public debate in the Soviet elite (abundantly covered by the Soviet press) over the causes of weak innovation and the relative advantages of various solutions. This suggests in turn a growing realization in the Soviet Union that the traditional strategy of concentrating scarce resources on a handful of high-priority projects cannot produce rapid gains in productivity and quality for the economy as a whole, or even continue to meet the requirements of military industry.

Simultaneously, however, the Soviets have also pursued a second strategy, that of importing large amounts of Western equipment and know-how, with the aim of making rapid gains in lagging or hard-pressed sectors of the economy, such as the chemical industry. What, if any, is the relationship between these two strategies? This report makes several preliminary findings: (1) Recent Soviet managerial reforms to stimulate innovation are only distantly inspired by Western example; (2) Soviet managerial reforms and Soviet technological import programs do not appear to be directly related to one another or mutually reinforcing; (3) high-technology imports by themselves do not enable the Soviets to achieve independence in innovation; (4) however, the more highly developed the Soviets' native capabilities in a given branch of

technology the better able they are to profit from transferred technology to generate further advances of their own.

These findings suggest that the Soviets are failing to exploit the potential advantages of systematically combining Western high-technology imports and domestic reforms in the management of innovation. In certain high-priority sectors (notably military), where Soviet technological skills are already high, the Soviets' ability to learn from foreign technology is also high. Here, then, there is a clear case for export controls. But in the lagging areas in which most Soviet imports of foreign technology are concentrated, the Soviets' record in absorbing and learning from it is poor. The reasons are much the same as the ones that cause those areas to lag in the first place: They lie deep in the political and economic structure of the country, and numerous reform measures in Soviet technology policy over the last twelve years have not altered them. Neither have high-technology imports visibly improved the Soviets' ability to innovate on their own, in some instances the opposite. It is this second class of cases and the difficult matter of distinguishing it from the first that most of the American uncertainty is about.

This report argues that within the second class of cases the most effective barriers to technology transfer are those erected by the Soviets against themselves. Consequently, so long as Soviet policies for technological innovation remain as ineffective as they are now, the claimed benefits of any expansion of U.S. export controls should be examined carefully. Export controls have important if marginal political benefits, as this report will show, but they also have costs, and the task before us is to arrive at a sound balance between the two.

No one in the United States questions the need to control exports of direct military importance. To the extent that American security continues to rest on a lead in critical military technologies, then safeguarding technological lead-times is clearly in the nation's interest. Something like the present system of case-by-case evaluation, aimed at preventing clear and immediate military use of American technology by the Soviets, must and undoubtedly will continue. But the issue today is what to do about the possibility that the United States is giving away indirect military advantages through subtle channels that may call for more subtle defenses. The danger is not so much the possibility of sudden and disastrous give-aways, but rather that high-technology trade may help the Soviets to upgrade over the longer term the traditionally neglected "civilian" industries that will provide broad, infrastructural support for new weapons systems tomorrow. Does foreign technology help the Soviets to overcome those obstacles, and can an expanded system of export controls prevent them from doing so? This report's answer to the first question is, "Partially" (and we do not underestimate the seriousness of that fact); but its answer to the second question is, "Probably not."

It is worth bearing in mind that in the total volume of Western high-technology exports to the Soviet Union the United States is a small player. American high-technology exports to the Soviet Union in 1979 amounted to \$183 million (\$270 million to Eastern Europe as a whole), about one-tenth the level of Soviet imports of advanced machinery and equipment from West Germany, France, and Japan combined. The chances of gaining much support from other countries for an expanded system of export controls are small and growing smaller, for among the nations conducting high-technology trade with the Soviet Union one finds not only NATO allies (whose reluctance to apply stiffer export controls is of long standing), but also countries like Australia, Denmark, and Switzerland, which are unlikely to cooperate at all. Consequently we should not imagine that an expansion of export controls would be free of serious political costs; indeed, it might be unenforceable at any acceptable cost.

The issue of technology transfer to the Soviet bloc is a new instance of a very old problem: how to prevent the diffusion of valuable skills across national boundaries. History teaches that the control of technology transfer is at best a rear-guard action, achievable (and then only

briefly) at the cost of regulations and secrecy that carry harmful side-effects of their own. This fact has not prevented every advanced nation from trying to impose controls at one time or another; in fact, since the beginnings of the industrial revolution, periods of relatively free exchange and transfer have been briefer than eras of control. But in the end the transfer of technology depends less on the fact that knowledge and skills have been divulged than on the fact that the receiver knew how to make creative use of them. From the loss of the secrets of porcelain manufacture by the Chinese to the loss of the secrets of the Sidewinder by the Americans, the ultimate consequences depend on the ability of the receiver to profit from them—and on the ability of the donor to generate more.

It follows that balancing the political costs and benefits of export controls requires weighing their claimed effects in delaying the Russians against their costs in straining our relations with our allies and impeding the competitiveness of our exports. Our first concern should be to remain good innovators ourselves. The case for export controls is strongest in areas in which the United States stands to make near-term military gains and in which the United States has a clear lead over other Western countries. As one moves outside this zone, toward technologies that afford the Soviets longer-term industrial gains and that are not areas of clear American superiority over the rest of the West, the benefits of export controls become more diffuse and uncertain, while the costs of trying to enforce them become progressively greater. Any widening of export controls outside the first range into the second should be undertaken only with the greatest care.

It is important to note that one issue that this report deliberately does *not* address is that of employing embargoes or other selective controls on East-West trade as political levers to influence Soviet behavior in the international arena. The issues of "leverage" or "linkage" are far larger questions, raising as they do the use of economic and technological instruments to make important political points, which can be effective as symbolic statements of American positions even if their actual technical effects are minimal. The author of this report does not necessarily quarrel with such uses of export controls; that is a question for the political process to decide. But in making such determinations it is most important to know whether export controls are effective in their *stated* aim (namely, to preserve military lead-times and the national security), to clarify what those aims imply in operational terms, and to know the costs. If this report succeeds in focusing some of the national debate around those basic technical questions, its aim will have been achieved.

briefly) at the cost of regulations and secrecy that carry harmful side-effects of their own. This fact has not prevented every advanced nation from trying to impose controls at one time or another; in fact, since the beginnings of the industrial revolution, periods of relatively free exchange and transfer have been briefer than eras of control. But in the end the transfer of technology depends less on the fact that knowledge and skills have been divulged than on the fact that the receiver knew how to make creative use of them. From the loss of the secrets of porcelain manufacture by the Chinese to the loss of the secrets of the Sidewinder by the Americans, the ultimate consequences depend on the ability of the receiver to profit from them—and on the ability of the donor to generate more.

It follows that balancing the political costs and benefits of export controls requires weighing their claimed effects in delaying the Russians against their costs in straining our relations with our allies and impeding the competitiveness of our exports. Our first concern should be to remain good innovators ourselves. The case for export controls is strongest in areas in which the United States stands to make near-term military gains and in which the United States has a clear lead over other Western countries. As one moves outside this zone, toward technologies that afford the Soviets longer-term industrial gains and that are not areas of clear American superiority over the rest of the West, the benefits of export controls become more diffuse and uncertain, while the costs of trying to enforce them become progressively greater. Any widening of export controls outside the first range into the second should be undertaken only with the greatest care.

It is important to note that one issue that this report deliberately does *not* address is that of employing embargoes or other selective controls on East-West trade as political levers to influence Soviet behavior in the international arena. The issues of "leverage" or "linkage" are far larger questions, raising as they do the use of economic and technological instruments to make important political points, which can be effective as symbolic statements of American positions even if their actual technical effects are minimal. The author of this report does not necessarily quarrel with such uses of export controls; that is a question for the political process to decide. But in making such determinations it is most important to know whether export controls are effective in their *stated* aim (namely, to preserve military lead-times and the national security), to clarify what those aims imply in operational terms, and to know the costs. If this report succeeds in focusing some of the national debate around those basic technical questions, its aim will have been achieved.

I. INTRODUCTION: A CRITICAL LOOK AT HIGH-TECHNOLOGY EXPORT CONTROLS

Is the United States putting itself in danger by failing to control more carefully the export of scientific knowledge, technology, and management know-how to the Soviet Union? Alarmed by the rapidly growing military strength of the Soviets, we wonder uncomfortably whether we have inadvertently contributed to it, through scientific exchanges, turnkey and training agreements, sales of licenses, or exports of high-technology products and processes. A decade ago, confident of our military strength and of the superiority of our civilian technology, and hopeful about the possibilities of cooperation with the Soviet Union, we began dismantling the virtual trade embargo we had maintained against Eastern Europe for nearly twenty years, and set about expanding trade and contacts. We are far from that optimism now.

On January 4, 1980, President Carter ordered a suspension of licensing for high-technology exports to the Soviet bloc pending a full review of the U.S. government's export-control policy. Although his immediate aim was to show American displeasure over the Soviet military action in Afghanistan, his action was the culmination of several years of mounting dissatisfaction in Washington with the export-control system in effect since 1969, numerous but inconclusive attempts to revise it, and severely divided opinions—all reflections, in turn, of growing American apprehension about Soviet policies and intentions.¹ Consequently, the review of export-control policy launched in the last year of the Carter administration is part of a general rethinking of the premises of American policy toward the Soviet bloc, a rethinking that has undoubtedly only begun and does not promise to be easy.

The aim of this report is to take a new and critical look at the objectives and assumptions of U.S. high-technology export-control policy. In such a difficult issue there are no simple answers; therefore it is only fair to the reader to provide a preliminary map, showing where the argument is headed.

In the last five years the United States has moved, albeit for logical reasons that will be explained below, toward an export-control system that could be more complex, costly, and controversial than any we have had before. At the same time Americans remain ambivalent about the objectives of export controls and unclear about what such controls can achieve and what they cannot. Our thinking will be considerably clarified, however, if we bear in mind that the most important question about technology transfer in the long run is whether the receiving side is able to absorb the technology it imports, to diffuse it beyond one or two showcase locations, and to build upon it to generate further technological advances of its own. Only then does technology transfer have its most lasting consequences.

If we rethink the export-control question on that basis, then our focus shifts from the characteristics of the proposed export or its potential end-uses (the issues that the American debate tends to dwell on most) to the Soviets' ability to learn from it. Here we must distinguish between two classes of cases: In certain high-priority sectors (notably military), where Soviet technological skills are already high, the Soviets' ability to learn from foreign technology is also high. Here, then, there is a clear case for export controls. In contrast, in the lagging areas

¹Previous Rand work on the subject of technology transfer includes: Charles Wolf, Jr., *U.S. Technology Exchange with the Soviet Union: A Summary Report*, The Rand Corporation, R-1520/1-ARPA, August 1974; Robert E. Klitgaard, *National Security and Export Controls*, The Rand Corporation, R-1432-1-ARPA/CIEP, April 1974.

in which most Soviet imports of foreign technology are concentrated, the Soviets' record in absorbing and learning from it is poor. The reasons are much the same as the ones that cause those areas to lag in the first place: They lie deep in the political and economic structure of the country, and (as we shall see) numerous reform measures in Soviet technology policy over the last twelve years have not altered them. Neither have high-technology imports visibly improved the Soviets' ability to innovate on their own, in some instances the opposite. It is this second class of cases, and the difficult matter of distinguishing it from the first, that most of the American uncertainty is about.

This report will argue that within the second class of cases the most effective barriers to technology transfer are those erected by the Soviets against themselves. The effects of internal Soviet obstacles, in fact, dwarf those of the most stringent embargo the Western powers might devise. Consequently, so long as Soviet policies for technological innovation remain as ineffective as they are now, the claimed benefits of any expansion of U.S. export controls should be examined very carefully. Export controls have important if marginal political benefits, as this report will show, but they also have serious costs, and the task before us is to arrive at a sound balance between the two.

Such in brief is the position this report intends to argue. Whether one accepts it or not largely depends on one's view of the Soviet Union as a technological innovator, and consequently much of the report deals in detail with that question. We shall examine the reasons why the Soviet Union has experienced chronic problems with technological innovation; we shall look at the reforms undertaken in the last twelve years and their underlying significance; and we shall inquire into the role of imported technology in the Soviet domestic effort. But first it will be useful to review the recent evolution of American policy on technology transfer, in order to understand its aims and assumptions and to isolate the most important unresolved issues.

It is important to note that one issue that this report deliberately does *not* address is that of employing embargoes or other selective controls on East-West trade as political levers to influence Soviet behavior in the international arena. The issues of "leverage" or "linkage" are far larger questions, raising as they do the use of economic and technological instruments to make important political points, which can be effective as symbolic statements of American positions even if their actual technical effects are minimal. The author of this report does not necessarily quarrel with such uses of export controls; that is a question for the political process to decide. But in making such determinations it is most important to know whether export controls are effective in their *stated* aim (namely, to preserve military lead-times and the national security), to clarify what those aims imply in operational terms, and to know the costs. If this report succeeds in focusing some of the national debate around those basic technical questions, its aim will have been achieved.

EVOLUTION OF AMERICAN EXPORT-CONTROL POLICY

The basis for the present system of controls is the Export Administration Act of 1979 (Public Law 96-72), which mandates prior review and approval by the federal government of any proposed export that "would make a significant contribution to the military potential of any other nation or group of nations which would prove detrimental to the national security of the United States."² The agency with primary responsibility for this system is the Commerce

²50 USC2401 et seq. A summary of the provisions and legislative history of the 1979 Act can be found in the *Congressional Quarterly Almanac* for 1979, pp. 300-305.

Department's Office of Export Administration, but several other government offices must also review and concur, notably the Defense Department, which judges the possible military significance of proposed exports. In practice, decisions on controversial cases are made by consensus, which sometimes requires long negotiation to reach.

For the past ten years, the successive versions of the Export Administration Act (the present Act is the fourth since 1969) have been uneasy compromises between two objectives, that of protecting the national security and that of promoting exports. During that period, on the whole, encouragement of foreign trade has been Congress' foremost concern; and framers have attempted to limit and define precisely the situations in which export controls will be invoked. In the past two years, however, anxiety about national security has risen in Congress as in the rest of the nation, and the issue of reconciling the competing objectives in export-control legislation is coming once again to the fore. The matter is complicated by the fact that the distinctions involved are inherently slippery. Just about any export, including feed grain or drilling technology, can be considered a "significant contribution" to Soviet military potential, provided one adopts sufficiently broad definitions. Hence, every time the Act comes before Congress for review (as in 1974, 1977, and 1979), it gives rise to anxious debate.

To try to cope with the distinctions between military and civilian applications of exports, the Departments of Commerce and Defense maintain a Commodity Control List of items with possible military applications. The decision to grant or deny an export license for any item on that list requires judging, case by case, how likely it is that it will actually be diverted to a military end-use and, if the likelihood is considered high, whether suitable checks or alterations can be devised to remove the danger. It goes without saying that this process takes time, and one of the chief complaints of American companies and members of Congress over the years has been that the system is so cumbersome that it costs the United States valuable export business. On that count alone the present export-control system would be controversial. However, the real problems go deeper.

New generations of weapons rest on a multitude of advanced supporting technologies that cannot be said to be inherently either military or civilian. It follows that diversion to military uses constitutes less and less often a clear act that one can identify and control. Even the most plausible diversion scenarios have their ambiguities. Can a Sperry Univac 1100/10C computer, sold to a Soviet design agency in the synthetic-rubber industry, be diverted to perform three-dimensional differential equations for aircraft-wing stress analysis at the nearby Tupolev plant?³ Amid the flurry of concern over whether it has been or might be, one should point out that synthetic rubber is of military importance too, and that a good eight-year-old computer technology is likely to have a greater marginal impact in that industry than in the top priority Tupolev facility, which presumably is already well provided for.

A further difficulty with the end-use principle, in the eyes of its critics at least, is that it tends to emphasize transfer of "hard" products and processes, physical quantities that can be identifiably diverted, whereas an equally crucial question is the transfer of know-how and supporting skills. In the computer example mentioned above, we worry about the quality of the software that the Soviets may be importing along with the Univac; and diversion of software is, of course, more difficult to spot and deter than that of hardware. Defenders of the present export-control system insist that such know-how and "soft" technology are recognized as problems and are adequately controlled; critics say they are not.

³Peter J. Schuyppen, "Soviets' Univac Arouses Concern," *New York Times*, January 3, 1980, p. D1.

Washington's growing awareness of these issues in the mid-1970s led to the development of a new concept and a proposed new strategy based on so-called "critical technologies," which has now been incorporated into official policy in the 1979 Export Administration Act. The term arose out of a panel convened by the Department of Defense in 1975, chaired by the President of Texas Instruments, J. Fred Bucy. The panel's recommendations, issued the following year,⁴ contained three important concepts that have since gained wide currency: (1) The proper object of control is the export of manufacturing and design know-how rather than end-products alone; (2) "active" mechanisms of transfer (such as turnkey or training arrangements) are more apt to be consequential than "passive" ones (such as trade fairs or export of finished products); and (3) rather than attempt to construct impermeable barriers to the transfer of militarily significant technology, the aim of the control system should be to retard the flow so as to protect lead-times in the military areas in which the United States has a significant edge.

Each of these three points has important implications. First, by stressing the *mechanism* of transfer, the Bucy criteria stress that the transfer of an object or a process may be less important than the transfer of a skill, and that one of the most important questions about such transfers is the *way* they are made. Second, by focusing on classes of technologies rather than specific items, the Bucy criteria appear to offer relief from the increasingly futile and time-consuming task of tracking down possible military end-uses and diversions. Finally, by emphasizing that the goal of American policy should be to preserve critical lead-times (thus conceding that it is hopeless to prevent military end-uses indefinitely), the Bucy criteria require us to think clearly about the nature and sources of the American lead, in other words, about what technological superiority really consists of in the first place and how it should be defended.

Despite these real virtues, there is serious question whether the critical-technologies approach will improve the export-control system. On the contrary, if we are not careful it could make the system more complex, cumbersome, and controversial than any we have previously had. The "Initial List of Militarily Critical Technologies," issued in October 1980 by the Department of Defense,⁵ illustrates the danger. It contains a virtual roll-call of leading contemporary techniques, including videodisk recording, polymeric materials, and many dozens of others equally broad. If this collection had automatically become the basis for the official Commodities Control List (as some had urged during the debate over the 1979 Export Administration Act), the entire Department of Commerce would not have been large enough to administer the export-control program. Fortunately the Initial List has advisory status only, and one may be confident that it will undergo refinement before it becomes the actual basis for policy.

The underlying problem, which the legislative history of the successive versions of the Export Administration Act in the 1970s shows clearly, is that American policymakers have been uncertain about the effects and dangers of high-technology exports to the Soviet bloc.⁶ What exactly are we trying to prevent the Soviets from doing? In what ways does imported Western technology enable the Soviets to do the things we fear? Can export controls stop them or slow them down? These three questions are central to any export-control policy, but there

⁴Department of Defense, Office of the Director of Defense Research and Engineering, *An Analysis of Export Controls of U.S. Technology—A DoD Perspective*, a report of the Defense Science Board Task Force on Export of U.S. Technology, Washington, D.C., February 1976.

⁵*Federal Register*, Vol. 45, No. 192, October 1, 1980, pp. 65014-65019. A recent statement of Dr. Bucy's views will be found in "Technology Transfer and East-West Trade," *International Security*, Vol. 5, No. 3, Winter 1981, pp. 132-151.

⁶Useful background will be found in Organization for Economic Cooperation and Development, Committee for Scientific and Technological Policy, *Technology Transfer Between East and West*, Paris, 1980. See also Marie Lavigne, *Les Relations Economiques Est-Ouest*, Presses Universitaires de France, Paris, 1979.

has been considerable confusion about all three of them. In particular, if our goal is to preserve lead-times it is soon apparent that we have two different sorts of lead-times to worry about: the lead embodied in individual weapons systems and that embodied in the underlying technologies that generate them. Each has its own dangers; and consequently each requires its own sorts of information and its own strategies. What is needed, in other words, is cooler and more systematic thinking about the effects and dangers of technology transfers. In the next subsection this report offers some suggestions.

EFFECTS AND DANGERS OF TECHNOLOGY TRANSFER

In the broadest terms, transfers of technology have three classes of possible consequences: The Soviets may gain (1) direct, near-term military advantage; (2) indirect, longer-term military advantage; (3) a boost to their overall economic growth. Which of these should the United States try to limit through export controls?

Direct, Near-Term Military Advantage

Imported Western technology could yield the Soviet Union a direct, short-term military advantage in two possible ways. The first is a transfer leading directly to a revolutionary Soviet breakthrough. The second is a transfer that suddenly fills a gap, overcomes a bottleneck, or completes a puzzle in an otherwise mature Soviet technology, enabling the Soviets to proceed to a rapid expansion of numbers or a sudden generational improvement in a major weapons system. As a hypothetical example, the revelation of the Ulam-Teller principle, during the crucial period when the Soviets were groping for an efficient fusion-fission coupling of their own, would have been an example of the first kind. A case of the second kind (which we shall discuss in some detail below) may have been the sale to the Soviet Union of high-precision micro-ballbearing grinders, used in the manufacture of highly accurate guidance systems for intercontinental missiles.

A subcategory in the second group is the inadvertent giveaway, in which the technology in question is a readily available item whose military significance the Russians may realize ahead of the Americans. A plausible hypothetical example is Kevlar, the casing material that contains the propellant in the Trident I, initially developed by DuPont for use in radial tires. Kevlar's potential military applications were realized by accident, when defense contractors happened to come across it at an aerospace fair on the West Coast.⁷ In this case, the serendipitous discoverers happened to be Americans, but there is no reason why they could not have been Russians. Plastics and synthetic rubber, indeed, have been high on the list of chemicals and chemical equipment purchased by the Soviet Union in recent years. The job of anticipating such cases will become steadily more difficult in years to come, as new weapons systems incorporate a progressively wider range of supporting technologies, such as new synthetic materials and fuels, micro-electronics, and so forth.

As nightmarish as these possibilities sound, it is important to recognize that the chances of a sudden doomsday giveaway through trade are next to nil. First, the military balance between the two countries is stable and well buffered. In strategic weaponry, for example, the

⁷Deborah Shapley, "Technological Creep and the Arms Race: ICBM Problem a Sleeper," *Science*, Vol. 201, September 22, 1978, p. 1104.

redundancy built into the U.S. Triad is so great that no single new weapon will confer meaningful advantage in the short term. The day when the simple invention of the stirrup swung the balance of power on the Asian continent is long over. (Of course, maintaining the Triad requires periodic deployment of new weapons systems. But such deployments—however heated the debate surrounding them—take decades to plan and execute, which shows how stable the basic system is.)

Second, major weapons systems rest on a multitude of different technologies, so that no single breakthrough will produce a sudden advantage; whether in undersea acoustics, look-down shoot-down air defense, missile guidance, "stealth" avionics or high-energy lasers, major developments come from an accumulation of advances over long years, most of them involving basic sciences that are being actively studied on both sides. Threats from such a quarter can be seen from a long way off, and therefore no single transfer can possibly produce a total surprise. (The enormous publicity given by the Western media to Soviet efforts in charged-particle-beam technology illustrates this point strikingly.)

Third, in the research sectors of immediate military relevance the Soviet Union maintains a level of effort that may be better funded and in some cases more advanced than that of the United States.⁸ Most of their weaknesses, as we shall see below, lie in traditionally "civilian," lower-priority, supporting technologies. Experience suggests that in high-priority sectors, in which the opponent is already well equipped and heavily engaged, the most important transfer is simply the sure knowledge that something is possible and is being achieved elsewhere. This appears to have been Fuchs' most important contribution to the Russians, for example, in the case of the hydrogen bomb.⁹ Needless to say, the prevention of such transfers, though desirable, lies outside the export-control issue. The same is true of the fact that, where the West possesses a clearly superior technology of direct military importance, the Soviets have demonstrated the ability to spirit away what they need by means other than trade, as in the case of the design for the Sidewinder missile.

In sum, the fear that the United States is unwittingly selling the rope that the Russians will shortly use to hang us is hardly credible. In the areas of technology that might yield direct military advances, the Soviets depend less (and are less willing to depend) on foreign trade than they do in other, traditionally lower-priority areas. No single export item will produce a lightning-bolt surprise, for any such transfer would be so obvious that it could not be overlooked; and even if it were it could not be converted into sudden strategic advantage. It goes without saying that the commercial export of technologies with clear and immediate military applications must be controlled where possible; but despite occasional headlines to the contrary there is no serious evidence that our present control systems (particularly the Munitions List) fail to do this. As we shall see in the next two subsections, the knotty parts of the technology transfer issue lie elsewhere.

Indirect, Long-Term Military Advantage

The more difficult issue in export-control policy is not whether the West is selling the Russians the rope but whether we are selling them the capacity to make it themselves, by

⁸For example, in an address in May 1979 to the Center on Science and International Affairs of Harvard University, Undersecretary of Defense William Perry stated that the Soviet Union may well be investing five times more effort in high-energy laser research than the United States.

⁹See the discussion by Herbert York in *The Advisors: Oppenheimer, Teller, and the Superbomb*, W. H. Freeman, San Francisco, 1976.

helping them to overcome technological lags in the broad industrial infrastructure needed for tomorrow's advanced weapons systems (not to mention tomorrow's economic growth, which we shall address next).

We are currently witnessing throughout the world a blurring of the boundaries between military and civilian technologies, and the Soviet Union is no exception. Tomorrow's weapons systems will depend on new materials and alloys, advances in communications and data processing, manufacturing and fabricating techniques, automation of assembly and auxiliary operations, new skills, and techniques of management. The traditional Soviet strategy of maintaining an isolated high-priority zone for military deployment and production, while simultaneously skimming the cream from the civilian economy for military use, becomes self-defeating when military technology requires the entire range of skills and techniques of an advanced industrial economy.¹⁰ No small part of the current Soviet anxiety over the weaknesses of their R&D policy and their management of technological innovation stems from their increasing awareness of the backwardness of several crucial areas of what had hitherto been neglected as "civilian" technology. Therefore, the greatest benefit of foreign technology to the Soviets may be to bring up to a fully modern standard the "infrastructural" civilian technologies that are emerging as the crucial ones for tomorrow's military strength.

The question is, Can this problem be dealt with through any remotely feasible export-control policy? As soon as one shifts one's focus from weapons systems to the technologies embodied in them, virtually any high-technology product, process, or skill becomes militarily relevant. From there it is but a short step to declare that all advanced technologies should be subject to export controls. The Initial List of Militarily Critical Technologies, mentioned earlier, illustrates the problem: Its critical weakness is that it is simply a listing of techniques that, if exported to a military competitor, *could* be harmful to us; it does not contain any clear conception of how or why technology transfer actually takes place. It implicitly assumes that advanced technology is like virulent disease: It is enough for the recipient to be exposed for him to catch it.

However, studies of actual cases show that that is not how technology transfer works at all. Imported technology will not be of more than passing benefit to the Soviet Union unless that country is able to use it to develop its own innovative capacities, to generate further technology, and to diffuse it broadly and quickly. If the Soviets fail to gain that capacity, then imported technology will in many ways only perpetuate their backwardness and dependence (and we will see instances of that phenomenon in the next section), since by the time it is installed and functioning it is already out of date. *Therefore the crucial point to examine is the extent to which foreign technology helps overcome the root problems that have been holding back Soviet technological innovation in the first place.*

We shall return to that question in the subsequent sections of this report. However there remains one last class of effects to be discussed.

Long-Term Economic Effects: Reinforcement or Displacement?

Foreign technology, whatever else it may do, contributes to the overall growth of the Soviet economy. In the near term, the higher productivity of Western products and processes gives

¹⁰In reality, there has always been considerable overlap between the Soviet civilian and military sectors, so that what we are really talking about is differences of degree. Nevertheless, in recent years the degree of overlap has greatly increased. See for example Simon Kassel's study of sources of Soviet basic research for laser technology: *The Relationship Between Science and the Military in the Soviet Union*, The Rand Corporation, R-1457-DDRE/ARPA, July 1974. See also a suggestive work by John E. Kiser, III, "Civilian and Military Technology in the USSR: Is There a Difference?" (unpublished).

a boost to quality or efficiency of Soviet output; in some specialties, such as the manufacture of mineral fertilizers, this effect is striking. Over the longer term, Western technology has served as a model and a standard, providing a stimulus to progress that is often lacking within the Soviet system itself.

The contribution of Western technology to Soviet growth may not be large in global terms.¹¹ But Soviet leaders have frequently used foreign technology to make a fast start in a branch of industry that has suddenly risen in importance and priority; this occurred notably in chemicals in the 1950s and 1960s, in the automotive industry in the 1960s and 1970s, and in the energy sector beginning in the 1970s. Thus foreign technology helps Soviet leaders respond rapidly to new policy needs.

These broad economic effects of foreign technology, rather than the narrower military ones, appear to be uppermost in the minds of the Soviet leaders themselves, for signs of economic trouble confront them wherever they look. Declining output and productivity, shortages of labor and key resources, low quality and poor performance—these are the symptoms of a disease whose existence the Soviet leaders themselves no longer try to deny. And one of the principal remedies to which the leaders have resorted, after lengthy debate and much swallowed pride, has been to import unprecedented quantities of foreign technology.

This development raises the most difficult questions of all for Western export-control policy. Is it in the interest of the United States to try to prevent the Soviet Union from turning to foreign technology to boost economic growth? And if so, are export controls the appropriate instrument for the job? The 1979 Export Administration Act, as we have seen, authorizes the use of export controls to protect the national security, and particularly to prevent transfers that would contribute to the military potential of unfriendly powers. Should fertilizer plants, mills for specialty steels, or oil-drilling technology be banned on the grounds that, because they contribute to Soviet economic growth, they contribute significantly to Soviet military potential? This question has a variant that has proved especially thorny: what if imported technologies free resources that the Soviets can then displace toward the military sector?

Let us take up the latter question first: Its plausibility turns on several difficult questions of fact. First, do we really know that imported technology releases resources? Some Western experts argue, on the contrary, that foreign technology *ties up* scarce resources, because every ruble of imported equipment requires something like five rubles of investment support (in the form of supporting infrastructure and training of personnel), in order to absorb it and make it work.¹² If the priority of the receiving sector is high enough, it may have such a strong claim on scarce resources that it competes with the military.

A more fundamental objection to the displacement argument is that it assumes that the Soviet allocation system treats resources as fungible between the military and civilian sectors. That assumption cannot be demonstrated to be true. What little evidence we have concerning Soviet military spending (and, for that matter, military R&D) suggests a steady, incremental increase through the Brezhnev period, unaffected by the substantial ups and downs of trade in high-technology goods. In other words, there is no evidence that the Soviets would spend less on the military and more on the civilian economy in the absence of high-technology trade. The pattern corresponds instead to what we would expect to observe if the Soviets followed a lexical

¹¹See, for example, the discussion in Philip Hanson, "Western Technology in the Soviet Economy," *Problems of Communism*, Vol. XXVII, No. 6, November-December 1978, pp. 20-30. During the Ninth Five-Year Plan (1971-75) 15 percent of the capital equipment installed was obtained from abroad, although not all, by any means, from the West. See *Izvestia*, February 18, 1976, cited in A. I. Bel'chuk, ed., *Novyi etap ekonomicheskogo sotrudnichestva SSSR s razvityimi kapitalisticheskimi stranami*, "Nauka," Moscow, 1978, p. 7.

¹²Some Soviet sources make the same point. See Bel'chuk, *op. cit.*, p. 14.

decision rule, with the military treated as first claimant until its "needs" (however defined) are met, and other claimants treated as residual.¹³

The displacement argument, furthermore, assumes that the civilian and military sectors are separate and competitive rather than complementary and mutually reinforcing. But is not an increase in oil drilling in Western Siberia as much a contribution to the military, in the long run, as it is to the "civilian" economy? Imported technology in recent years has been concentrated primarily in industries that the Soviets have been systematically building up rather than deliberately neglecting, industries to which the Soviets are simultaneously directing considerable native R&D. There is no denying that the military sector enjoys the highest priority in the land. What cannot be shown, however, is that the Soviets use foreign technology to wring every last kopeck from the civilian economy to benefit the military.

Still, there is no doubt that the extreme priority enjoyed by the military in the allocation of Soviet resources puts the rest of the economy under severe strain. If that strain became great enough, might not the Soviet leaders be forced to review their priorities and reroute some scarce resources to "civilian" purposes, the energy sector for example? Why then should the West help relieve the strain? An answer one sometimes hears is that, regardless of what happens to the military sector, a technologically backward or energy-starved Soviet Union is a special danger to the rest of the world. Consequently, in this view, it is not in the interest of the West to attempt to impede Soviet economic growth. But is it really true that the Soviets are deprived because they are deprived? There is no particular evidence either way. What stands out, instead, is the essential continuity of Soviet foreign policy over the years, through good economic times and bad. In sum, as one picks one's way through the thicket of arguments about Soviet economic growth, one reaches no clear answers.

Therefore let us reason instead from the standpoint of feasibility. Even if we should like to slow down Soviet economic growth (not necessarily a foregone proposition), it is quite another matter to ask whether we *can*, and whether export controls (or even embargoes) are the right instrument for the job. Here it is important to remember that the effects of export controls are inherently marginal. That is, they will not halt Soviet economic or military development; at most, they may slow it down slightly at the margin. (American defense planners mean nothing different when they speak of preserving this country's military lead-time; that is the same as a moving margin.) And as in any public policy, the sound aim is equilibrium at the margin, that is, to confine export controls to the classes of cases in which the marginal political benefits are readily identifiable and outweigh (or at least balance) the marginal political costs of obtaining them.

What happens if we apply this criterion to the three classes of effects of technology transfer that we have been discussing? The benefits of attempting to control near-term military effects are *immediate* and *specific*; those of controlling long-term economic effects are *remote* and *diffuse*. At the same time, the costs of the former are likely to be lower than those of the latter, since they are more likely to command the agreement of our allies and more likely to involve technologies in which the United States is genuinely dominant. It follows that, *from the standpoint of feasibility*, a system of controls narrowly defined around the prevention of near-term military effects is the one most likely to have results, while one broadly aimed at impeding Soviet economic growth is likely to be self-defeating.

But what about the middle category, that of long-term and indirect military effects? Here we need to ask one more question: How *consequential* are the effects of technology transfer in

¹³We have benefited from the careful discussion of displacement and fungibility in Klitgaard, *op. cit.*, pp. 27-35.

each category? Near-term military effects, as alarming as they are, are nevertheless passing, because the military technologies of both countries are moving rapidly. What *really* maintains lead-times is the comparative ability of both countries to generate new advances, and here it is the long-term effects of technology transfer that may be the most consequential ones, if they affect that comparative ability to innovate. Consequently, the case for export controls in this middle category must turn on evidence that a proposed export package would help the Soviets remove fundamental obstacles standing in the way of their own innovative ability, in some way that the Americans are in a unique position to deny. Whether there exists such evidence is the main question addressed in the rest of this report.

To illustrate and sum up this discussion, let us reconsider a famous case: the decision to allow the export to the Soviet Union of precision grinders for the manufacture of micro-ballbearings, an essential component in advanced guidance systems for intercontinental ballistic missiles.

A Famous Case: The Sale of Micro-Ballbearing Grinders to the USSR

In August 1972, after much internal debate within the American government, the Department of Commerce approved the sale to the Soviet Union of 168 precision machines manufactured by the Bryant Grinder Corporation of Vermont.¹⁴ Micro-ballbearings find many applications in commercial aircraft and other civilian uses. They also play a crucial role in the three-gimbal high-precision gyroscopes used in the current generation of long-range missiles of both the United States and the USSR.¹⁵ The approval of the Bryant grinders sale, together with the fact that the Soviets began the first flight tests of MIRVed missiles less than a year later, touched off accusations at the time that without the imported machines the Soviet Union could not have gone into production of the new missiles.¹⁶

The official view of the intelligence agencies today is that the Bryant grinders arrived in the Soviet Union too late to have played a crucial gap-filling role in the development of the Soviet fourth-generation missiles. Moreover, the Soviets already possessed similar foreign machines before 1972, purchased from non-American manufacturers; even at the time of the sale the Bryant grinders were no longer the most precise or advanced grinders available, as evidenced by the fact that some American firms at the time were already using Japanese grinders made by Seiko Seiki.¹⁷ Nevertheless, some continue to feel that the case demonstrates the perilous holes in the American export-control system, and insist that the "machines are making a distinctive contribution to the Soviet military effort and could very well be producing the precision miniature ballbearings used in current and follow-on high-quality MIRV guidance systems."¹⁸

At the time of the Bryant case, the Soviets already had some experience in micro-ballbearing manufacture, but much of it was semi-artisanal. As one Soviet professor acknowledged in

¹⁴The Bryant grinders case is discussed in some detail in U.S. Congress (House), Committee on International Relations, *Export Licensing of Advanced Technology: A Review*, Part II, U.S. Government Printing Office, Washington, D.C., 1976, pp. 5-7, 13-17, and 25.

¹⁵Shapley, *op. cit.*, p. 1103.

¹⁶Statement by Retired General Daniel Graham, former head of the Defense Intelligence Agency, as reported in Dan Morgan, "U.S. Reportedly Sold Soviets Means to Make MIRV Part," *Washington Post*, February 26, 1976, p. A3.

¹⁷See the House Committee Report, *op. cit.*

¹⁸See also Dr. Miles Costick's testimony before the House Armed Services Committee, reported in *Defense and Foreign Affairs Daily*, June 11, 1979; testimony by Dr. Jack Vorona, Assistant Vice-Director for Scientific and Technical Intelligence in the Defense Intelligence Agency, before the Senate Armed Services Committee, *ibid.*, November 14, 1979.

Izvestiia, Soviet-made grinders in the early 1970s were not precise.¹⁹ "Until quite recently," says another Soviet expert, they were forced to rely on highly qualified workers using "essentially manual" methods for the final polishing and finishing of micro-ballbearings, coupled with a rigorous inspection system that rejected a high proportion of the output.²⁰ At the Il'ich Machine-Tool Factory in Leningrad, the main Soviet producer, an attempt to develop high-precision machine tools with sub-micron tolerances had ended in failure in the late 1950s, and nothing had been done since. By the late 1960s, says a recent newspaper story,

the factory was closer to the preparation of simple grindstones and breechblocks for machine guns than to the inconceivable precision of instruments. . . . For the long years that passed from the time of the unsuccessful attempt, there occurred no breakthroughs of any kind at the factory or in the Sverdlov Machine-Tool Association to which it belonged. And the people there remained basically as before and no one had any technical inspiration.²¹

It was around this time that the president of the Bryant Grinder Company visited the Il'ich factory. According to the same newspaper account,

He walked around all of the factory shops and came away in a good frame of mind. He became animated and candid:

"My impression? I could give you drawings of all our machine tools but you would gain nothing. You cannot make machine tools for manufacturing instrument bearings with such technology, with such equipment and materials, and with such personnel."

The "personnel" frowned but looked at the Bryant president with interest. When Bryant was mastering precision and conquering markets and growing rich, these "personnel" were boys and were making breechblocks for machine guns under the inconceivable conditions of the Leningrad blockade.

The Soviets were in a difficult position. Imported high-precision machine tools were costing tens of millions of dollars every year in scarce hard currency, and unfilled orders for ballbearings were piling up.²² Worse, their dependence on foreign technology for such an important class of components was perceived as a political liability:

Bryant could rejoice and not fear competition. It asked vast sums for its outstanding machine tools—\$75,000 each. . . . However, there were also other, non-arithmetical considerations. The Bryant firm could trade with us but could also not trade—for political reasons.

One glimpses in this account a not-uncommon Soviet scene: outmoded plant, underqualified artisans set in traditional ways, managers with little incentive to innovate, and a history

¹⁹A. Murashkin, Professor at the Leningrad Polytechnical Institute, "Sverkhvysokaia tochnost'," *Izvestiia*, July 15, 1979, p. 2.

²⁰Iu. Tarbeev (Director-General of the scientific-production association (nauchno-proizvodstvennoe ob"edinenie) or NPO "VNIIM," Leningrad), "Osobennosti," *Prauda*, September 6, 1979. The Americans have a similar problem. In 1976, Edwin Speaker of the Defense Committee gave the following comment on rejection rates: "... If you look at the probable number of precision bearings that have to go into each missile guidance system and make a reasonable judgment as to what the rejection rate is of your best bearings, it is something like 9 out of 10 bearings sets have to be rejected because of the difficulty of producing the really good ones. That is a process we use in this country. We produce 10 bearings and then pick the best ones and it is about one-tenth of gross production. So it is a very expensive process." His comment is in the House Committee Report, op. cit., p. 16.

²¹Ia. Strugach, "The Logic of Victory," *Leningradskaiia Prauda*, November 11, 1980. Translated in *Joint Publications Research Service*, No. 77305, February 3, 1981, pp. 1-6.

²²During the period 1971-1975, the Soviets claim to have spent 215 million "exchange rubles" for machine tools for instrument bearings. See Strugach, op. cit.

of dependence on foreign technology. Yet within less than a decade, or so the Soviets claim, the situation was utterly transformed: they report that they have developed their own high-precision machine tools capable of grinding the raceways of miniature ballbearings to tolerances of two ten-thousandths of a millimeter.²³ This new line of mass-produced machine tools has made it possible to eliminate the backlog of orders for precision ballbearings in less than two years, and was evidently considered successful enough to be advanced as a candidate for a State Prize.²⁴ The newly mastered technology allows closer tolerances than Western equipment, and one Soviet source claims it has earned the Soviets patents in several major countries, including the United States.²⁵ Most important, it has made further imports unnecessary.

Now, assuming the Soviet accounts have any truth to them, what new light do they put on the Bryant grinders case? First, the articles confirm that around the time of the Bryant grinders sale the Soviets could not meet the necessary close tolerances for mass manufacture of micro-ballbearings.²⁶ Therefore one may surmise that the Soviets did indeed derive a direct, short-term gain from foreign technology, though possibly most of all among nonmilitary customers who had been obliged to accept second-quality output. It cannot be excluded that the Soviets derived a military benefit as well, although not (because they arrived late) from the Bryant grinders themselves. But it may be argued that that fact in itself is not the most significant part of the story, for the direct short-term gain that the Soviets may have realized was at best passing. The real news is that the Soviets now claim to have equalled or bettered Western capabilities, a development that affects not only missile accuracy but Soviet capabilities wherever precision ballbearings may be used. What happened to produce such a startling change, and what role did Western technology play in overcoming obstacles?

The most important initial step, apparently, was to put sufficient political priority behind the project, and in that sense what follows is a familiar Soviet scenario, which we shall discuss more systematically in the next section. High-level political interest was evident from the first: around 1970 the head of the special design bureau of the Il'ich plant, together with the managers of the factory and the parent Sverdlov Association, were summoned to Moscow for consultations at the CPSU Central Committee, the Council of Ministers, and the State Planning Committee (Gosplan). But there was considerable hesitation in high places:

Our work began in difficult circumstances [relates the head of the special design bureau]. They did not believe that we, the developers, could create our own original machine tools and no worse than Bryant's. And we the designers, in turn, did not believe that the factory could produce such precise equipment. No, this was not skepticism relating to one another's capabilities. We could not in those years risk giving up purchasing imported equipment while we still did not have our own. . . .

²³Murashkin, *op. cit.* See David Holloway, "Military Technology," in Ronald Amann, J. M. Cooper, and R. W. Davies, eds., *The Technological Level of Soviet Industry*, Yale University Press, New Haven, Connecticut, 1977, p. 472.

²⁴However, it apparently did not succeed, because it was not mentioned in the published list of recipients of State Prizes for 1979.

²⁵At the basis of the new technology, according to Professor Murashkin, is the use of ultrasonic waves, which make it possible to use diamond-chip cutting wheels with the necessary stability and governability. In addition, use of ultrasonic waves, directed at the spindle about which the bearing rotates during manufacture, has made it possible to cut vibration between the bearing and its spindle by a factor of a hundred. New optical methods were developed to supervise the grinders' operation. All in all, the new technology led to thirteen Soviet patents (*avtorskie svidetel'stva*), but Murashkin (unlike Tarbeev) mentions no foreign ones.

²⁶In addition, the rate of output was not sufficient to meet their needs. In 1976, Edwin Speaker of the Defense Intelligence Agency stated, "We know that the Soviets have produced reasonably good gyroscopes and accelerometers which have been flown in ICBMs prior to the sale of these grinding machines." House Committee Report, *op. cit.*, p. 6. Mr. Speaker subsequently added, "... to produce the quantities would require full capacity to a fairly large national production capability just to support, say, the SS-19 program. . . ." (p. 16).

At the 25th. Party Congress (1971) and at the drafting of the country's 9th. Five-Year Plan, this question among others of state importance was debated: Should we buy machine tools abroad or begin our own domestic manufacture?...

Opinions on the subject were varied; we will omit the heat and conflict and say only that it was decided to try again to create machine tools.

We see here, incidentally, another familiar theme: The skepticism of higher authorities about the capabilities of their own people has long been a sore point among Soviet technical personnel, as well as a source of real difficulties to them.²⁸ At any rate, the 1971 decision was evidently still a somewhat tentative one, for the project was not written into the Main Guidelines of the Ninth Five-Year Plan (that did not happen until the Tenth), and the personnel of the Sverdlov Association were under constant high-level pressure to prove what they could do. By around 1974, they had something to show:

At the factory there soon stood six machine tools: two Bryants, two of the first domestics, and two exact copies of the American ones. (They were able to make them in the shops.) A specially created commission visited [from Moscow]. Stocks of bearing rings were brought in. The machine tools passed the test. All six worked. Our first models rivaled the foreign ones and did not lag behind them.

The cautious commission made a rare decision: They considered it possible to permit trials for domestic machine tools.

With many difficulties, which meant doing it by hand, during the span of two years 1975 and 1976, ten machine tools were prepared at the factory—the whole gamut of equipment for manufacturing instrument bearings.²⁹

That was the first big step, and on the strength of it the project was written into the Main Guidelines for the Tenth Five-Year Plan, in late 1975. Still, the most difficult part lay ahead: to go from a handmade prototype to a series model. This is consistently one of the most troublesome spots in the Soviet R&D cycle; indeed, most of what is officially reported as innovation in the Soviet Union consists of designs that are never produced in more than ten copies. (This point is discussed later in this report.) But by 1977 the Il'ich plant had produced 53 of the new machine tools, and in the following year another factory (the State Ballbearing Plant No. 5, also located in Leningrad) joined in. In 1978, output reached 209 units, and in 1979, 234.³⁰

What lies behind this apparent success? Rapid progress appears to have come once a sufficiently high-level coordinating group was appointed to bring together the organizations working at different points of the R&D cycle, particularly some basic-research institutes.³¹ Another key element was the extra financial support and management attention that high

²⁷Strugach, op. cit.

²⁸See for example the memoirs of a former Soviet electronics expert who was involved in military R&D until his defection in 1971. A. Fedoseev, *Zapadnia*, Frankfurt: Posev, 1976.

²⁹Strugach, op. cit.

³⁰Strugach, op. cit.

³¹Tarboev mentions: (1) the Special Design Bureau for Polishing Equipment (SKB shlifoval'nogo oborudovaniia), (2) the Sverdlov Machine-Tool Association (stankostroitel'noe ob"edinenie imeni Sverdlova), (3) the All-Union Scientific Research Institute for Abrasives and Polishing (Vsesoiuznyi nauchno-issledovatel'skii institut abrazivov i shlifovaniia), and (4) the State Ballbearing Factories Nos. 4 and 5. Finally, the writer himself is director-general of the Mendelev Science-and-Production Association (NPO VNIIM imeni Mendeleeva). All of these organizations are located in Leningrad.

political priority made possible. This proved to be especially important at the stage of developing series production: the Ministry of Instruments (Minipribor) provided additional millions at this point, and relieved the Il'ich factory of some other production assignments. Something like the well-known Hawthorne Effect seems to have spurred the efforts of the workers at the Il'ich plant, a by-product of high-level attention.³¹

What caused the Soviets to commit themselves to the machine-tool project when they did? The timing of the final go-ahead, coinciding as it did with the deterioration of U.S.-Soviet commercial relations in 1974-1975, could lead one to speculate that the essential stimulus for the Soviet effort was the threat that the foreign supply might be cut off. However, our brief look at the history of the decision shows that the actual reasons were more complicated, beginning with the fact that the initial Soviet decisions were made in 1971, when detente was at its height and U.S.-Soviet trade was on the verge of a major expansion. It is perhaps closer to the truth to say that the Soviet move was motivated by the rapidly growing demand for micro-ballbearings in Soviet industry and the growing liabilities of importing them, and not by any particular event in the West.

This glimpse at the Soviet context of a controversial case, precisely because it raises more questions than it answers, underscores the fact that implementing a sound export-control policy requires more attention to the sources of Soviet problems, to the range of Soviet efforts to overcome them, and to the role of foreign technology transfer in that process. These three questions, then, are the subject of the next five parts of this report, following which we shall return to the policy implications of the findings.

³¹Strugach, *op. cit.*

VII. CONCLUSIONS

The aim of this report has been to contribute to the current rethinking of American policy on technology transfer to the Soviet Union by discussing on the implications of recent Soviet efforts to improve their own technological innovation. We wish to know whether these efforts have altered the technological transfer problem, by improving the ability of the Soviets to profit from foreign technology by using it to generate and diffuse further advances of their own. In this concluding section we summarize our findings and draw out their chief implications, together with some recommendations for American policy.

First, what exactly is at issue? No one in the United States questions the need to control exports of direct military importance. To the extent that American security continues to rest on a lead in critical military technologies, then safeguarding technological lead-times is in the nation's vital interest. Something like the present system of case-by-case evaluation, aimed at preventing clear and immediate military use of American technology by the Soviets, must and undoubtedly will continue.

Rather, the issue today is what to do about the possibility that the United States is giving away indirect military advantages through subtle channels that may call for more subtle defenses. The main danger is not so much the possibility of sudden and disastrous give-aways, but rather that high-technology trade may help the Soviets to upgrade over the longer term the traditionally neglected "civilian" industries that will provide broad, infrastructural support for new weapons systems tomorrow. Some of the most significant obstacles to Soviet military progress come from deficiencies in the civilian sector (for example, computers, communications, energy, and new materials), and this drag can only increase in the future, as military development comes to depend more and more intimately on the combined technological skills of a nation's entire industry. But does foreign technology really enable the Soviets to overcome those obstacles, and could an expanded system of export controls prevent them from doing so?

The major weakness of the present system of controls, in the view of some of its critics, is that it allows important technology to slip through to our military competitors by paying too much attention to the export of products, and not enough to the control of skills, techniques, and know-how. Consequently the most recent U.S. legislation mandates the development of a review procedure that will control classes of critical technologies rather than individual products. Recent American thinking focuses particularly on "active" mechanisms of transfer, such as training agreements, long-term technical exchanges, extended workshops, and other apprenticeship-like arrangements that teach skills and know-how.¹

It is important to explore carefully the implications of such a broadening, because it can lead to excesses. A recent example that gives food for thought is the decision made at the beginning of 1980 to bar Soviet representatives from attending two technical conferences in the United States—one on bubble memories and the other on laser fusion—in order to prevent transfer of the knowledge discussed there. The two meetings involved technical data directly related to development and manufacture; therefore the Department of Commerce held that the participation of the Soviets required a license, which the Department chose to deny. Other

¹U.S. Congress, Public Law 96-72, Export Administration Act of 1972, September 29, 1979.

foreign delegates were asked to sign pledges that they would not reveal what they had learned at the meetings to colleagues from communist-controlled countries.²

This episode suggests what a broadened export-control doctrine could lead to: First, it tempts us to put pressure on allied governments and their citizens, to induce them to cooperate with our expanded export-control program, despite the fact that support for export controls has been declining abroad.³ The Carter Administration experimented with economic reprisals against the French firm Creusot-Loire for concluding a contract with the Soviet Union that Washington disapproved of; and the logic of the critical-technologies approach, if we mean to apply it seriously, will lead us toward more measures of the same kind.

Second, the attempt to control "active" mechanisms of technology transfer may inhibit unimpeded and rapid international communication of technical skills and information, at a time when the United States is moving from the position of a dominant supplier of leading technology to that of a beneficiary of foreign advances, and is therefore increasingly dependent upon free exchange. Unless we are judicious about them, expanded export controls could cost us considerable good will among important commercial partners in the West.

To put these points in perspective, it is worth bearing in mind that in the total volume of Western high-technology exports to the Soviet Union the United States is a small player. American high-technology exports to the Soviet Union in 1979 amounted to \$183 million (\$270 million to Eastern Europe as a whole), about one-tenth the level of Soviet imports of advanced machinery and equipment from West Germany, France, and Japan combined (see Table 5). Direct scientific contact is also quite small. The 13 U.S.-Soviet bilateral agreements, at their height, involved little more than 1000 people from each side each year, most of them on carefully orchestrated and necessarily superficial two-week visits. The scientific exchange program conducted by the two countries' Academies of Sciences supports fewer than 250 man-months of visits from each side, few of them involving actual research.⁴ Moreover, it is unlikely that extension of most-favored nation treatment and credits by the United States would change this situation much, because the Soviets have taken some care throughout the 1970s to diversify their sources of supply and to limit their indebtedness (see Table 6).

In view of these modest dimensions, it is clear that the effect of whatever policy the United States pursues will be slight compared to the actions of our principal allies, and slight also in its overall effect on Soviet science and technology, given how little actual contact there is between the two countries. The chances of gaining much support from other countries are small and growing smaller, for among the nations conducting high-technology trade with the Soviet Union one finds not only NATO allies (whose reluctance to apply stiffer export controls is of long standing), but also countries like Austria and Switzerland, which are unlikely to cooperate at all.

Consequently we should not imagine that an expansion of export controls would be free of

²Nicholas Wade, "Science Meetings Catch the U.S.-Soviet Chill," *Science*, Vol. 207, March 7, 1980, pp. 1056-1058.

³For a recent report, see Angela Stent Yergin, *East-West Technology Transfer: European Perspectives*, The Washington Papers, No. 75, Sage Publications, Beverly Hills, California, 1980.

⁴The basis for the expanded exchanges of the 1970s was a series of eleven agreements signed by the American and Soviet governments between May 1972 and June 1974, which increased tenfold the volume of technical visits between the United States and the Soviet Union. For descriptions and evaluations, see Lawrence H. Theriot, "Governmental and Private Industry Cooperation with the Soviet Union in the Fields of Science and Technology," in U.S. Congress, Joint Economic Committee, *Soviet Economy in a New Perspective*, U.S. Government Printing Office, Washington, D.C., 1976, pp. 753-755; National Academy of Sciences, National Research Council, *Review of the US/USSR Agreement on Cooperation in the Fields of Science and Technology*, Washington, D.C., 1977; and Loren R. Graham, "How Valuable Are Scientific Exchanges with the Soviet Union?" *Science*, Vol. 202, October 27, 1978, pp. 383-390; see also Francis W. Rushing and Catherine P. Ailes, "An Assessment of the USSR-US Scientific and Technical Exchange Programs," in U.S. Congress, Joint Economic Committee, *Soviet Economy in a Time of Change*—Vol. II, U.S. Government Printing Office, Washington, D.C., 1979, pp. 605-624.

Table 5

SOVIET IMPORTS OF WESTERN TECHNOLOGY*

Index No.	Class of Import	USA	West Germany	Japan	France
		1977/1978	1977/1978	1977/1978	1977/1978
10	Machinery, equipment, and transportation	351/273.5	1041.5/1004	685/830	566.5/688
100-103	Metal-cutting and shaping, and fabrication	17/11	154/157	21/46	9/14
10515	Electrical and power engineering equipment and manufacturing facilities for same		14/12	11/18	30/23.5
110-111					
113					
12303	Metal rolling equipment	0.5	68.5/101	3.5/43	20.5/11.5
127	Petroleum-refining equipment			25.5/157	3.5/29.5
128	Drilling, extraction, and exploration	21/38	15/10		12/0.5
150	Chemical-industry equipment	113/42.5	274/238	286/233	350.5/406
154	Road-building	30.5/53		17.5/34	
15501	Pumps	17/7	11.5/9	7.5/2	1/1.5
15931	Computers	8.5/25		2/1	2.5/4
15932					
15941					
170-171	Instruments and lab equipment	8/8	17/12	12/10.5	8/10.5
178-179					

SOURCE: *Vneshniaia torgovlia SSSR v 1978g.: statisticheskii sbornik*, "Statistika," Moscow, 1978.*In 10⁶ rubles, rounded to the nearest half million.

Table 6

SOVIET IMPORTS OF METALWORKING MACHINERY AND EQUIPMENT

Exports	Value (in thousands of rubles)							
	1970	1971	1972	1973	1974	1975	1976	1977
Total	425,311	294,434	430,264	589,561	747,936	941,358	976,316	1,059,025
From Developed West	315,967	155,303	231,389	360,083	489,855	593,797	581,337	557,164
F.R.G.	65,733	39,290	90,355	126,481	165,322	203,963	240,288	230,728
U.K.	25,498	17,282	23,394	32,929	10,567	23,199	22,805	8,792
U.S.A.	11,534	10,039	20,480	51,495	55,439	91,318	71,064	34,205
	Shares (in percent)							
	1970	1971	1972	1973	1974	1975	1976	1977
DW of Total	74.3	52.7	53.8	61.1	65.5	63.1	59.6	52.6
F.R.G. of DW	20.8	25.3	39.0	35.4	37.9	34.3	41.3	41.3
U.K. of DW	8.1	11.1	10.1	9.1	2.2	3.9	3.9	1.6
U.S. of DW	3.7	6.5	8.9	14.3	11.3	15.4	12.2	6.1

SOURCE: Soviet trade handbook—*Vneshniaia torgovlia SSSR, 1970-1978*.

serious political costs; indeed, it might be unenforceable at any cost. Before we make the attempt, therefore, we should be clear on whether technology transfer actually has the effects we fear and whether expanded export controls would make a substantial difference. Hence the emphasis of this report on the environment in which exported technology is received. We turn now to a summary of our essential findings.

Broadly speaking, in the last decade the Soviets have pursued two strategies simultaneously to improve the technological level of their economy. The first is a "quick fix" approach, aimed at modernizing backward branches of industry quickly through large-scale imports of foreign equipment and plant. In certain industries, notably those which manufacture chemical equipment, agricultural technology, automobiles, machine tools, precision instruments, and pipeline and drilling equipment, the Soviets have relied on Western suppliers for a large part—in some cases the virtual entirety—of new productive capacity. The industries involved here have been a varied lot, and in no two cases has Western technology played exactly the same role. However, two general traits appear to hold for most of them:

- The resort to massive imports has come suddenly each time, as a result of ad hoc political decisions to upgrade the priority of the industry concerned (e.g., the "chemicalization" campaign under Khrushchev). Therefore the turn to Western technology in such cases is only partly the result of the inability of the industry to respond to sudden demands placed upon it (e.g., to increase the output capacity of fertilizer from 10 to 100 million tons in one five-year period, or more recently, to expand the output of light automobiles beyond one million new cars a year). The possibility of turning to foreign suppliers has given Soviet leaders a freedom for rapid maneuver that the rigidity of Soviet economy denies them.
- The quick-fix import programs rely on import of finished products above all, such as complete plants and heavy equipment. And while considerable training and demonstration are involved, they are centered primarily on the management of well-established technology, i.e., that embodied in the finished product, rather than the transfer of skills that confer the ability to generate further innovation or diffuse the acquired technology rapidly.

These two features have implications that we shall return to below.

The second principal strategy is internal reform of the management of technological innovation. Though less spectacular than the first strategy, it is potentially further-reaching, since it is aimed at the root causes of Soviet backwardness. Soviet literature on technological innovation goes back more than fifty years, pointing to many of the same problems and complaints as today, but the last ten years have witnessed an unprecedented degree of soul-searching and experimentation on the part of Soviet officials and experts at all levels. Such efforts testify to a growing Soviet recognition that their traditional approach to promoting economic growth and higher productivity is no longer adequate.

The crucial instrument in that traditional approach is the selective allocation of priority. For military purposes, for example, two principal techniques have long been used to secure scarce resources and manpower: a Manhattan-Project style of organization for large, high-priority ventures, combined with a systematic skimming of the highest-quality output from ordinary producers throughout the economy, by means of ubiquitous "military representatives" (*voenpredy*) stationed in factories in every industry, armed with the authority to select and commandeer output that meets the military's requirements. By means of such devices, the Soviets are able to concentrate effort, materials, and skills on the most important projects related to national security and other top priorities.

However, priority is by definition a scarce resource. There is evidence that some dilution of its effects has already occurred in the last two decades, as a result of the need to bring an ever-broader array of industries and technologies into play with each new generation of weaponry.⁵ But priority that is no longer priority becomes meaningless, and attempting to spread it thinner is no substitute for thorough-going reform in the incentives and organization for innovation. Indeed, military-related industries themselves have pioneered many such devices and they are now being extended to important civilian industries. One way of looking at recent Soviet experiments in technology policy is to consider them a wager on the Soviets' part that management devices perfected under high priority will yield good effects when applied where priority is lower.

Throughout the Soviet period there has been an uneasy coexistence between foreign imports and home-grown enterprise (the latter usually entailing some degree of reform) as the two principal strategies for technological innovation, the former predominating in some periods (such as the First Five-Year Plan, 1928-1932) and the latter in others (such as the Second Five-Year Plan, 1933-1937). Logically, the two strategies should complement one another; but in practice they have tended to compete, and the balance between them swings with the state of mind of the Politburo, from emphasis on independence to emphasis on fast catch-up, and back again.⁶ The last fifteen years have been somewhat exceptional, for both strategies have been pursued simultaneously, and more vigorously than ever before.

The simultaneous existence of these two strategies raises a number of questions. First, to what extent are they connected, that is, does a crash program of Western imports involve at the same time a reform of the management of innovation in the industry involved? Do recent Soviet experiments in the management of innovation make the Soviets better able to profit from transferred technology? Are the Soviet experiments in the management of innovation themselves a species of "higher-level" technology transfer, which might be prevented or regulated? What do Soviet problems with both strategies reveal about the root causes of Soviet lag in technological innovation, and what further guidance do they give us about appropriate policies for technology transfer? The findings of this report suggest some preliminary answers:

1. *Recent Soviet reforms in the management of technology are only distantly inspired by or related to Western technology as such.*

In Soviet writings one can see evidence of a limited "transfer" of Western thinking about the management of R&D and innovation, and in particular, some effort to learn from American methods. Soviet specialists on the United States have devoted considerable attention to the American system of R&D policy and administration, focusing notably on issues that are known to be of special concern in the Soviet Union (such as contracts, research parks, or the structure of research corporations).⁷ We can tell that some of this knowledge actually finds its way to policymakers because American management methods have been copied in the Soviet space and military programs.⁸

On a broader plane, there has been a fashion in Moscow for Western management theory and Western-style computerization of management processes. Not only has Western management literature influenced a whole generation of Soviet management specialists, but through exchange programs and bilateral cooperation (as well as joint creations like the International

⁵For an interesting account of this phenomenon in military-sponsored Soviet work in radiolocation, see A. Fedoseev, *Zapadnia: Chelovek i sotsializm*, Moscow, 1977.

⁶See Bruce Parrott's excellent description of this ambivalence in official Soviet policy in his forthcoming book, *M.I.T. Press*, 1981.

⁷See Thane Gustafson, "American Science Policy Through Soviet Eyes: A Reflection of Soviet Concerns and Priorities," in John R. Thomas and Ursula M. Kruse-Vaucienne, eds., *Soviet Science and Technology: Domestic and Foreign Perspectives*, The George Washington University, Washington, D.C., 1977, pp. 83-100.

⁸Campbell, *op. cit.*, pp. 586-607.

Institute for Applied Systems Analysis), the Soviets are being exposed directly to Western techniques. They have based their own systems of management education on American models, notably the case method of the Harvard Business School. It is uncertain as yet how much actual change has been wrought by this movement, but it is undoubtedly a leaven in Soviet thinking about industrial productivity.⁹

These Western examples, however, have had only marginal effects on the reform effort as a whole. The Soviet experiments we have discussed in this report are primarily Soviet in inspiration, modeled on Soviet antecedents, and addressed to characteristically Soviet problems. The defects they are aimed at arise out of the Soviet system of planning and organization, and consequently address specifically Soviet worries about incentives, information flow, financing, priority-setting, coordination,¹⁰ and failure of effective demand for innovation. That these problems are systemic, i.e., generated by the Soviet economic and political system, can be seen from the fact that much the same issues and problems have been stock concerns in Soviet science-policy literature ever since the first Five-Year Plans.¹¹

2. *Soviet crash imports and internal management reform do not appear to be directly related or mutually reinforcing.*

There is only a very partial overlap between the "long-term" reforms discussed in this report and the "quick-fix" import programs. The massive import of Western equipment is not usually accompanied in the same industry by a massive program to change management of innovation, and there is little apparent effort to exploit the synergistic effects that presumably exist when massive technology imports and internal management reform occur together. It is as though the two types of moves were decided upon independently, by different kinds of people. Most of the recent imports of Western technology, as already mentioned, have been concentrated in chemical equipment, machine tools, automotive manufacture, agricultural equipment and, increasingly, in extraction and transmission of oil and gas. These are not, by and large, the ministries that have made the most highly publicized efforts to reform the management of technological innovation.¹² The main exceptions to this observation are the computer and instruments industries, to which we shall return below.

Why has there not been a better "fit" between the two strategies? For the moment we can only speculate. First, they address different problems in different time-frames. The attraction of massive imports is that they promise to be fast and simple, conferring quickly the capability to get an important job done. The Academy of Sciences, for example, has recently imported a lot of advanced Western instrumentation to improve Soviet performance in biochemistry and molecular biology, once-neglected subjects that have been promoted to top priority recently because of the possible industrial applications of genetic engineering. At the same time, the Academy has created special instrumentation associations to produce advanced equipment at home. The latter effort will take years, but in the meantime, thanks to imported instruments, the Soviets are making rapid strides in the life sciences. In this case (one of the few in which

⁹One of the most important vehicles for this kind of "transfer" is the monthly journal of the Institute for Economics of Industrial Production of the Siberian Division of the USSR Academy of Sciences, *Ekonomika i Organizatsiia Ekonomicheskogo Proizvodstva* (often referred to as "EKO").

¹⁰See Berliner, *op. cit.*

¹¹For a discussion that illustrates this point strikingly, see Robert Lewis, *Science and Industrialization in the USSR: Industrial Research and Development 1917-1940*, Holmes and Meier Publishers, New York, 1979. It is remarkable how many of the complaints, as well as the proposed solutions, are the same from the 1930s down to the present day. For comparison, see Organization for Economic Cooperation and Development, *Science Policy in the USSR*, Paris, 1969.

¹²That is not to say that some overlap does not exist. The Ministry for Petrochemical Machine-Building (Minsneftkhimash), which imports large quantities of shipment from the West, has pioneered a general-contractor approach to supplying equipment to new plants. The Ministry of Agricultural Machine-Building (Minselkhoz mash) has experimented with a new approach to demand and has learned much from its export activities. (We are indebted to Nancy Nimitz for these observations.)

foreign imports and domestic management reform are clearly occurring simultaneously), the difference between the two approaches is manifest: Foreign imports provide for the present and management changes provide for the future (so their originators hope).

The difference in time-frames between the Western-import and management-reform strategies may, in turn, spell further differences, notably in the kinds of people and organizations associated with each. The State Committee on Science and Technology, for example, is heavily involved in both imports and reform, but each strategy is presumably handled by different divisions, imports by the "branch" divisions that correspond to each of the major branches of industry and agriculture, and management reforms by the "functional" divisions that focus on matters such as the economics and organization of research and innovation.¹³

To be sure, there is one mechanism, not yet discussed in this report, that gives the State Committee, at least on paper, the potential for uniting the import and management-reform strategies. This is the system of "integrated programs" (*kompleksnye programmy*), a list of 200-odd high-priority "problems" established and overseen by the State Committee on Science and Technology. Each one encompasses the entire R&D cycle from basic research to final application in production. Together they cover one quarter of the total budget for research and development of the country.¹⁴ The "problems" are clearly of great potential importance as a management mechanism, for in addition to providing continuity from one stage to another in the R&D cycle, they afford the possibility, in principle at least, of systematically combining imported technology with internal changes. But it is not certain how effective the integrated programs have been in practice, because the influence of the State Committee over the ministries and their institutes appears weak, its control over funding and other resources is slight,¹⁵ and its own internal organization may discourage a truly integrated approach.¹⁶ Its influence over the trading organizations of the Ministry of Foreign Trade is equally uncertain.

The apparent failure to coordinate foreign imports and internal reform may involve a question of risk: Foreign technology, at least, has proved itself and is known to produce predictable results. Management reforms, if they produce results at all, are hard to measure, unpredictable in their effects, and probably slow to pay off. Soviet decisionmakers, in the short term, may place more confidence in the import strategy than in the management reform strategy. In essence, massive imports may be viewed as an extension of the "priority" method, that is, concentrating scarce resources on a need rather than implementing reforms to eliminate or alleviate the underlying problems.

¹³The State Committee on Science and Technology has an unusual administrative structure that may be designed to prevent a separation between the "branch" and "functional" activities of the committee: Each deputy chairman is in charge of some of both kinds. For example, Deputy Chairman M. G. Kruglov oversees both the Instrument Making and Radio Electronics Directorate (Chief: A. P. Yurkevich) and the Organizations and Economics of Scientific and Technical Research Department (Chief: V. A. Pokrovskii).

¹⁴S. Tikhomirov, op. cit. (1978b). For a lengthier description of the functions and powers of the State Committee on Science and Technology (unfortunately somewhat out of date), see *Organizatsionno-pravovye voprosy rukovodstva nauki v SSSR*, "Nauka," Moscow, pp. 158-169. This section, by G. A. Dorokhova, tends to be somewhat skeptical about GKNT's actual powers and effectiveness.

¹⁵Academician Paton, for example, gives the impression that the funding role of the State Committee is to supplement that of regular sources of support, by commissioning "supplementary" research themes, presumably ones that fit the overall programs. But such supplementary funding appears modest, in comparison with "mainline" sources of support. For example, according to Paton, the State committee funded 37 million rubles' worth of R&D in the Ukrainian Academy of Sciences during the period 1971-75, spread out over 354 projects. That makes an average of about 20,000 rubles per project per year, certainly not a crucial increment. Paton, op. cit. (1977), p. 50. As for GKNT's power to reassign funding among participating ministries, it requires the ministries' consent, and is therefore presumably requested only with diplomacy and circumspection. *Organizatsionno-pravovye voprosy rukovodstva nauki v SSSR*, op. cit., p. 124.

¹⁶According to an article by the Minister of Nonferrous Industry, P. F. Lomako, the State Committee on Science and Technology is hindered in overseeing any project that involves more than one branch of industry, because it is excessively narrowly structured by branch. P. F. Lomako, "Faktor vremeni," *Trud*, February 1, 1975.

The tenuousness of the connection between foreign technology transfer and internal reform must not be overstated. One can find examples of apparent ties between the two, such as the collaboration of NPO Plastpolimer with East German chemical engineers in launching the "Polymer 50" complex in Novopolotsk, or the interaction of "lead institutes" like the Paton Institute (electrowelding) or "production associations" like Elektrosila (heavy electrical equipment) with Western technologists (although we should bear in mind that all three of the organizations just named are long-standing and prestigious establishments despite their "new" labels, and as such more properly belong to Conclusion 4 below). Nevertheless, even in such cases one can trace no obvious synergistic effects coming directly from the simultaneous presence of foreign transfers and changes in the management of innovation.

The above is not meant to imply that Soviet leaders do not take reform of technological innovation seriously; on the contrary, it is clearly one of their dominant concerns. Rather, what lies behind all the possible explanations we have just enumerated is the plain fact that internal reform, since it involves changing basic incentives and patterns of communication throughout the industrial system, is a daunting proposition. Imported technology, on the other hand, does not require overhauling the economic system in order to put it to work. But as a consequence, the contribution of Western technology to Soviet innovative abilities is considerably diminished. The history of technological innovation and diffusion in the last two centuries teaches the importance of foreign example and instruction—but only if, at the same time, the political and economic institutions of the receiving country adjust accordingly.¹⁷

3. Imports by themselves do not enable the Soviets to overcome dependence, but may actually increase it.

The examples of the Soviet chemical and machine-tool industries, discussed in earlier sections, suggest that massive Western imports by themselves do not give the Soviets a capability for generating their own advances. Western imports have not compensated for these weaknesses; if anything, imports may have contributed to perpetuating them, by removing pressure for reform that the machine-tool industry might otherwise have been moved to respond to.

The Soviets have not passively accepted their weaknesses in these fields; they have attempted on several occasions to duplicate what they have been importing, but without conspicuous success (at least as far as one can judge from the anecdotal evidence available). It is not clear from the pattern of failures whether they are due primarily to weak science and engineering (the "supply" side of innovation), or weaknesses in management, incentives, and organization (the "demand" and "transmission" sides), or some combination of both (for one can presume that each affects the other two). Whatever the exact mix of reasons (and there is no reason to assume it is the same in every industry or branch), Western technology alone is apparently not enough to overcome them. Indeed, the very availability of Western technology may delay Soviet efforts to grapple with the root problems of innovation by making it less urgent in the short run to do so. The price, of course, is a continuing lag behind the Western state of the art, and though influential Soviets may feel humiliated by such lags,¹⁸ they may be thought of as the logical outcome of quite rational middle-term strategies on the part of the leadership, particularly in the handful of areas, such as agricultural chemicals, in which the productivity

¹⁷The earliest and still the most striking illustration in the modern era is the transfer of modern industrial skills from Great Britain to the Continent in the late eighteenth and early nineteenth centuries. See David S. Landes, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present*, Cambridge University Press, Cambridge, England, 1969.

¹⁸See Bruce Parrott's description in his forthcoming book, M.I.T. Press, 1981.

of imported Western technology is spectacularly higher than what Soviet enterprise would be able to achieve on its own.

4. *The more highly developed the Soviets' indigenous capabilities in a given branch of technology, the better able they are to profit from technology transfer (especially higher orders of transfer), and the less dependent they are likely to be.*

In some striking cases—such as heavy electrical equipment, welding, slag remelting, and heavy automotive equipment—the Soviets have demonstrated the ability to produce technology that, if not necessarily world-leading, is competent and capable of progress. It is internally generated, well adapted to Soviet needs and conditions, and increasingly competitive on world markets. In such areas the Soviets have demonstrated the ability to profit quickly and efficiently from Western technology, and the result is not dependence, but synergism, leading to an increase in Soviet technological strength in the fields concerned.

What accounts for this technological equivalent of the rich getting richer? This question actually contains two separate puzzles: First, what internal features of these industries account for their relative success? Second, what are the crucial skills or knowledge being transferred?

The traditional answer to the first question is high priority. But as we have seen earlier, there is considerable argument among Western specialists (and presumably among their Soviet colleagues too) about what high priority actually does. Clearly, one thing that high priority does is to assemble the best available elements that go into new technology: the best equipment, skilled manpower, and facilities. However, high priority on the supply side alone engenders ineffective protected industries, like the royal manufactures that mercantilist monarchies nurtured at great expense in the eighteenth century. The Soviet Union has done better than that by coupling higher priority with high pressure: deliberate stimulation of competition (e.g., among rival aircraft designers),¹⁸ strong user demand (as in the case of military customers), or clear yardsticks of performance with rewards attached (such as cost per kilowatt-hour of generated electricity).

The example of the automotive, machine-tool, and electrical-equipment industries suggests a further principle: that political priority, in order to stimulate native innovative performance, must (in addition to the factors mentioned above) be sustained. Sudden increases in priority, on the contrary, appear to be counterproductive as far as indigenous technological innovation is concerned, especially if they are accompanied by a sudden flood of foreign technology. Thus, in plastics, synthetic fibers, agricultural chemicals, energy exploration (e.g., offshore technology) and gas transmission the impact of high priority has been too sudden for successful innovative performance in the context of a supply and training system that reacts slowly.

We turn now to the second question raised above: Where direct contact with foreign technology has had an obviously stimulative effect, what exactly are the useful elements being transferred? The case of the KamAZ foundry is instructive. By maintaining on permanent location at the Pullman Corporation a large rotating delegation of top engineers, the Soviet Union was gaining something that in the scale of possible transfers falls somewhere in the middle between the most concrete (such as finished products) and the most abstract (such as broad management philosophy): skills in the organization of design, assembly, maintenance, costing, and quality control. Such knowledge, half science and half art (the difference is crucial, because for science alone the Soviets are reasonably well equipped), is best transferred through practical example and informal contact, in other words by a process that amounts to apprenticeship. These are subtle skills, whose transfer apparently requires close working contact over an extended period. What is striking, however, is that they also require a certain minimum level

¹⁸See the memoirs of the noted military aircraft builder A. Iakovlev, *Tsel' zhizni: sapiski aviakonstruktora*, Politizdat, Moscow, 1970.

of skill, experience, and receptiveness on the part of the receiver. Technology, like contagious disease, requires a receptive host.

The conclusions we have outlined so far suggest that the interaction of various types of technology transfer with the Soviet environment produces three distinct zones, each featuring hypotheses with different implications for American policy:

- A. *Transfer of finished products and processes as part of a Soviet crash program to improve an industry in which the Soviets start from a low level of capability.*

Hypothesis: In such cases the Soviet program of imports is poorly coordinated with internal improvements in the management of innovation, and yields no significant improvement in the Soviets' ability to generate and diffuse new technology on the basis of what they import.

Implication for policy: The consequence of such transfers is that they produce short-term gains in output capacity (such as synthetic fibers or plastics) rather than major improvements in innovative capabilities. From the standpoint of Western export-control policy, therefore, such transfers are of lesser concern, except insofar as they can be shown to overcome a major bottleneck in military-related production. Therefore the decision whether or not to grant an export license should depend primarily on whether the United States considers it expedient to contribute to the short-term production gains (such as increased oil production) for which the proposed export is intended.

- B. *Transfer of skills and know-how in industries in which the Soviets have already shown considerable innovative proficiency.*

Hypothesis: The higher the native capacity of a given industry for innovation, the greater its ability to absorb and diffuse foreign technology as well.

Implications for policy: American policy in such cases should be to control transfers that involve "apprenticeship" relations (training, extensive joint work, etc.). However, any such policy must be tempered by a realization that the most that may be possible in such cases is a limited holding action, since the learning ability of the Soviets will be greater in such cases than in the backward industries, and in most instances they will have alternatives available from other countries.

- C. *Transfer of general concepts about the management of incentive systems, information flow, division and coordination of tasks, etc.*

Transfer of "higher-order" skills of this kind may be important as a source of general examples. However, Soviet problems in the overall management of innovation arise not so much from the lack of foreign models—for there is every evidence that Soviet specialists are well acquainted with the models—but rather from long-standing, deeply rooted systemic obstacles to their implementation in the Soviet context. In addition, the Western literature on management and organization of innovation is so abundant and ubiquitous that it is hard to imagine any control mechanism by which its transfer could be prevented.

A CONCRETE ILLUSTRATION: THE CASE OF COMPUTER HARDWARE AND SOFTWARE

The Soviet computer industry in the late 1960s was a classic example of the effects of long neglect, compounded by faulty organization and management, limited user demand, and slow development of professional training. Since 1968, however, the Soviet computer field has

enjoyed sustained political priority, which has taken the form not of a crash import program but rather an effort to build native skills while following Western example, largely as filtered through Eastern Europe. Whether this strategy is more the result of Western export restrictions or Soviet determination to build independent capabilities is difficult to say, but at any rate the Soviet computer industry is now reaching the same fateful stage in its development that its Western counterparts reached at the beginning of the 1970s: The chief limitation on further progress is not hardware but software. But in software the Soviet dependence on Western technology has been even greater than in hardware,²⁰ and their own innovative success has been smaller. Finally, the field of computers and computer applications is one of the few very clear cases in which Western management concepts have had a major impact on Soviet actions, resulting in efforts (however limited as yet) to change management structure in Western directions. What implications follow?

Export of much general-purpose computer hardware falls into Category A as described above, provided it can be modified (as in so-called "C" modifications to lessen the speed of Univac computers) to prevent military end-uses. This position is justified by the very rapid pace of technological advance in the West, which makes transferred hardware obsolete long before the Soviets have succeeded in copying it (the Ryad series, described on pp. 24-25, is a case in point), and paradoxically also by the high priority of computer development in the Soviets' eyes, which guarantees that any wide-spread type of computer hardware not transferred to the Soviet Union by way of commerce will cross the border by some other means.

Export of software falls into Category B, particularly that portion of it transferred by "live" apprenticeship.²¹

Finally, export of more general knowledge such as organization of service or computer applications in business falls into Category C. In some ultimate sense, this is the most important category of all. As Seymour Goodman ably argues, the concept of a technology as a package, including service, training, peripheral technologies and applications, is more vital in the computer field than perhaps any other. However, such "conceptual" matter relating to the management of technology and innovation is easily transferred (indeed, its transfer is impossible to stop) but not easily applied. It falls therefore in Category C.

BALANCING THE BENEFITS AND COSTS OF EXPORT CONTROLS

The issue of technology transfer to the Soviet bloc is a new instance of a very old problem: how to prevent the diffusion of valuable skills across national boundaries. History teaches that the control of technology transfer is at best a rear-guard action, achievable (and then only briefly) at the cost of regulations and secrecy that carry harmful side-effects of their own. This fact has not prevented every advanced nation from trying to impose controls at one time or another; in fact, since the beginnings of the industrial revolution, periods of relatively free exchange and transfer have been briefer than eras of control. But in the end the transfer of technology depends less on the fact that knowledge and skills have been divulged than on the

²⁰S. E. Goodman, "Software in the Soviet Union: Progress and Problems," *Advances in Computers*, Vol. 18, Academic Press, 1979, pp. 231-287.

²¹See Charles L. Gold, Seymour E. Goodman, and Benjamin G. Walker, "Software: Recommendations for an Export Control Policy," *Communications of the ACM*, Vol. 23, No. 4, April 1980, pp. 199-207. Professor Goodman has been an active participant in the software subgroup of the Computers Technical Working Group (TWG.7), called to advise the undersecretary of Defense on the composition of the Militarily Critical Technologies List mandated by the Export Administration Act. The group has prepared an unofficial summary of its views, which the author is grateful to have had the opportunity to draw upon.

fact that the receiver knew how to make creative use of them. From the loss of the secrets of porcelain manufacture by the Chinese to the loss of the secrets of the Sidewinder by the Americans, the ultimate consequences depend on the ability of the receiver to profit from them—and on the ability of the donor to generate more.

It follows that balancing the political costs and benefits of export controls requires weighing their claimed effects in delaying the Russians against their costs in delaying us. An export-control policy based on the assumption that the enemy needs only to be exposed to superior American knowledge and skills in order to seize upon them, master them, and turn them into major gains prejudices the most important questions and may lead us into mistakes. The aim of this report has been to take a fresh look at the effects of technology transfers by calling attention to some of the important features of the Soviet context.

Naturally, this exercise is surrounded by uncertainties. To confirm or disprove the hypotheses advanced in this report, we would need to know a great deal more than we are ever likely to know, industry by industry, about Soviet strengths and weaknesses in generating and diffusing new technology. Neither do we know enough about how technological innovation works in general. We cannot predict in detail what kinds of transfers give Soviet technologists and managers the greatest help in improving their innovative performance—or for that matter our own. The translation of new ideas into new products and processes is still a mysterious business everywhere in the world, and no one explanation accounts for more than a fraction of the cases observed. This means, let us say it frankly, that it would be unwise to attempt to base any actual export-control policy on case-by-case evaluations of the Soviets' ability to absorb. The aim of this report is not to replace the critical-technologies approach with some sort of "critical-receivers" approach, for we simply do not have enough information or enough understanding to make it work.

Rather, the aim is to raise larger, cautionary questions about the broad course of export-control policy: Given the uncertainties surrounding any broadening of export controls, *in what direction is it safest to err?* The difficulties of technological innovation in the Soviet Union, and the largely negative results of recent reforms there, underscore some important points about innovation that are equally valid anywhere: First, however mysterious the details may be, it is clear that successful innovation depends on the presence of appropriate incentives and information. Potential inventors must know what opportunities exist and must stand to gain from good ideas, but also to lose from bad ones or from inaction. Potential users must know what has been invented and have both the motivation and the knowledge to choose correctly. If the Soviet system does not supply these incentives and information outside a narrow zone of closed high-priority projects, foreign imports will not fill the void.

Moreover, favorable climates for innovation, where they exist, are fragile. Regulation, however well-intentioned, introduces screens and filters between the perception of an opportunity for innovation and the inspiration and incentive to take advantage of it. Consequently, if the national purpose is to maintain the United States' technological lead, our first concern should be to remain good innovators ourselves. We should beware lest we hobble ourselves, as the Soviet system has so clearly succeeded in doing in the greater part of its industry.

What does this imply for export-control policy? The case for export controls is strongest in areas of immediate military relevance in which the United States has a clear lead over other Western countries. As one moves outside this zone, toward technologies that afford the Soviets longer-term industrial gains and that are not areas of clear American superiority over the rest of the West, the political benefits of export controls become more diffuse and uncertain, while the costs become progressively greater. Any widening of export controls outside the first range into the second should be undertaken only with the greatest care.

Mr. GUSTAFSON. Mr. Chairman, I will conclude my remarks by following up on a point that was made earlier about the Persian Gulf. One point that seems to be consistent in Soviet policy is the determination not to rely on outside suppliers for strategic materials.

My understanding is that there is only one outstanding example of a strategic commodity for which the Soviets have been willing to rely on the outside and that is bauxite. In view of this historical pattern, it would be most surprising if the Soviets were to consider seriously Middle Eastern suppliers as their saviors if they should have difficulties with oil.

Now, the past is not necessarily a guide to the future, but I think there is one more aspect to Soviet behavior in the energy area that suggests the same conclusion and that is the pattern of reluctance on the Soviets' part to rely on the outside for very much in the way of energy technology.

The spirit of the Soviet energy program, although there are question marks about how coherently it is conceived, nevertheless the spirit of the Soviet energy program is very clearly one of self-reliance for the most part. It seems to me that a leadership that is so focused on self-reliance in its energy program is not thinking seriously of driving into the Middle East in a desperate search for oil.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Gustafson follows:]

PREPARED STATEMENT OF DR. THANE GUSTAFSON

The recent publication of an important study by the Office of Technology Assessment, "Technology and Soviet Energy Availability," provides a welcome opportunity to evaluate the implications of Soviet energy policy and trade for U.S. interests. I thank the chairman, members, and staff of the Subcommittee on Investigations and Oversight for the opportunity to give my views, which are based on my research on East-West technology transfer and on Soviet domestic policy for technological innovation and energy (including participation as a project contractor in the OTA study mentioned above).

Devising a policy on energy-related technology transfer to the Soviet bloc is a knotty problem because it touches simultaneously on five of the most prominent issues of this decade: the future orientation of Western Europe, East-West technology transfer and its consequences for Soviet military power and economic growth, East-West trade and balance-of-payments problems, international energy security, and finally, the allocation of resources in the Soviet Union between military and civilian ends. Since different people will weigh the importance of these issues unequally, it will not be easy to form a consensus in the United States on East-West energy relations. The subject the Subcommittee is addressing today promises to be controversial for a long time to come.

These difficulties are compounded by uncertainty: as the OTA report makes abundantly clear, we have no precise way of knowing the relative likelihood of the possible futures for which we are trying to design a policy. Will the Soviets have an exportable energy surplus in 1990 or 2000, or will they, on the contrary, be badly short? Will the rest of the world still face energy supply disruptions like those of the 1970's, or does the relative oil abundance of the past year or two mark the beginning of a new phase in international energy security? Will the Soviets try to manipulate the natural-gas supply to Western Europe to serve their diplomacy, or will they be so strapped for hard currency that they will not wish to antagonize their trading partners? Can the U.S. retain or regain a significant lead in the major technologies relevant to energy? Such uncertainties make it difficult to decide, for example, whether energy-related trade with the Soviet Union significantly relieves the guns-vs.-butter choices facing the Kremlin, and if so, whether the United States should try to shut off such trade, knowing in advance that the attempt may fail.

The OTA report on Soviet energy makes an especially valuable contribution to our thinking because, while reminding us of the complexities and uncertainties of

the problem, it also helps us to structure it and to distinguish the parts we can do something about from those over which we have no control. In my remarks I would like to expand on some of the report's principal themes and to add a few additional ones in the lights of the most recent developments:

1. The Soviet energy problem is not primarily a technology problem, but one of infrastructure and quality, which calls less for innovation and advanced know-how than for sound management and massive investment. This is particularly and spectacularly true of the gas sector, where the success or failure of the Soviet program rides above all on the West Siberians' ability to install gas processing units, pumping stations, and large-diameter pipe across thirty thousand miles of countryside, much of it even more punishing than the North Slope. The outcome depends also on humble yet crucial tasks such as building gravel access roads, transmission lines, and schools and housing for workers and their families,¹ none of which requires particularly sophisticated technology.

2. The most important single problem for the Soviets is capital. The oil and gas sector in West Siberia, which is the key to Soviet energy performance for the remainder of this century, is scheduled to absorb 55 billion rubles in investment over the period 1981-1985,² which represents between 7½ percent and 7¾ percent of the entire investment budget of the country, at a time when the rate of growth of the latter has dropped sharply compared to that previous plan periods. Capital will evidently be extremely scarce throughout the 1980's, and it is not clear that the energy sector will be able to hold its own against competing branches of the economy in what promises to be a fierce struggle for resources, especially since to meet the leaders' announced energy goals would take up virtually the entire increment in the country's industrial investment funds over the next five years.³ In a recent speech, Brezhnev announced a 30-billion ruble cut in capital construction funds below the draft 11th. Plan. How much of that will come from the energy sector is not known, but the move confirms the severe difficulties the Soviet leadership will experience in meeting the targets (as modest as they are) of the next five years.⁴ To make the most effective use of their limited resources, Soviet gas officials announced in August 1981 that they plan to concentrate their development efforts on the giant Urengoy field alone, and postpone the development of Yamburg and the more northerly Yamal Peninsula fields until after 1985.⁵

3. The next most important problem in Soviet energy policy is management. Once again, Soviet gas is the crucial example, particularly gas pipelines: in the past, the Soviets have experienced severe difficulties with the reliability and efficiency of their pipeline network, partly because of their failure to build an effective infrastructure for their maintenance and operation.⁶ In recent months there have been numerous articles in the Soviet press on the problem of achieving proper coordination in building and operating gas pipelines on the gigantic scale called for. The relevant agencies do not work well together and there is no overall czar or interagency plan to overcome the prevailing lack of coordination.⁷ Early returns suggest that a Gosplan interagency commission established in Tiumen' last year to remedy this problem is not yet proving effective.⁸

4. It follows that most of the Soviet input needs in energy fall outside the traditional concerns of COCOM or the export-control system: for the most part, they do not involve dual-purpose technologies whose control is essential for the maintenance of military lead-times. Rather, we are talking about a class of Soviet imports that has been common in the last twenty years, in which the Soviet leaders use Western equipment to offset the rigidities of their economic system, getting off to fast starts in areas that suddenly become important in their eyes: automobiles, synthetic

¹ For a representative example of the abundant Soviet coverage of this subject, see A. Gramolin, "Chas' Urengoi," *Komsomol'skaia Pravda*, May 7 and 9, 1981.

² B. Trofimov, "Formirovanie tiumenskogo neftegazovogo kompleksa," *Planovoe khoziaistvo*, 9-1981, pp. 84-88.

³ For a rough calculation, see Gustafson, "From Big Coal to Big Gas: Soviet Energy Policy at the 26th. Party Congress," in Seweryn Bialer and Thane Gustafson, eds., "The Soviet Union at the Crossroads" (London: George Allen and Unwin, forthcoming spring 1982).

⁴ L. I. Brezhnev speech to a plenary meeting of the CPSU Central Committee, *Pravda*, Nov. 17, 1981.

⁵ V. Dinkov, "Zvenc energeticheskoi programmy," *Sovietskaia Rossiia*, Aug. 1, 1981.

⁶ The best discussion of this subject will be found in Robert Campbell, "Soviet Technology Imports: The Gas Pipeline Case," California seminar on International Security and Foreign Policy, Discussion Paper No. 91, Santa Monica, Calif., February 1981.

⁷ "Ratsional'noe ispol'zovanie material'nykh i trudovykh resursov na stroitel'stve magistral'nykh nefte- i gazotruboprovodov," *Planovoe khoziaistvo*, 4-1981, pp. 49-58.

⁸ Trofimov, *op.cit.*, p. 88.

fibers, plastics, etc. Indeed, the one thing the Soviets need most from the West is large-diameter pipe. We should be clear on one thing: to attempt to stop this kind of trade means to embark on something close to economic warfare, which would mean a return to a policy abandoned by the United States in 1969, with the passage of the Export Administration Act. For such an expanded system of controls it would be difficult to gain the Europeans' cooperation. Recent decisions by the French government, for example, signal clearly where the French are willing to work with us and where they are not: having approved French participation in the Urengoy pipeline to Western Europe, the French government has simultaneously indicated that it is inclined to deny approval for the export of computerized control equipment for the project.⁹

5. The main limiting factor in energy-related technology transfer is the Soviet ability to absorb it and put it to work. In many respects the Soviets have been their own worst enemies; in particular, they have usually been unwilling to allow Western technicians to operate on site, even though experience shows that such "embodied" transfer of know-how is by far the most effective mechanism for learning. An illustration of Soviet problems in absorption of foreign technology appeared recently in an exceptionally frank Soviet news story concerning the dismissal of the Soviet oil industry deputy minister in charge of advanced recovery methods.¹⁰ Having imported large quantities of detergents and chemicals (at considerable cost in scarce hard currency), this official proved unable to put them to use, and they piled up on railroad sidings around the country. This episode shows some of the classic elements of the Soviet problem: technological overoptimism, a stubborn insistence on going it alone, resistance by the established system, and half-hearted implementation.¹¹ However, a contrary case worth watching is the current role of the French company Technip in installing gaslift equipment at the crucial Samotlor field, a program which appears to be giving good results, not least because French technicians are working directly on location.

6. The recent agreements on the Urengoy pipeline to Western Europe are likely to be only the beginning of a long-term energy relationship between Western Europe and the Soviet Union which will involve more gas, but perhaps also more than gas. Soviet geologists estimate gas reserves from West Siberia alone at 27 trillion cubic meters.¹² Consequently, it is more than likely that there will be other pipelines to Western Europe. But the relationship could come to include other forms of energy cooperation as well, such as two-way flows of electricity, continued exports of oil and petroleum products, and engineering services for nuclear power. The implication for American policy is that, while it may be too late to wish away the first Urengoy pipeline to Western Europe, it is not too soon to start thinking systematically about ways of helping the West Europeans to deter supply interruptions (from whatever source) and to limit the damage in case deterrence fails. The Urengoy-West Europe pipeline is not the moral equivalent of the open barn door; there is ample time to develop a carefully reasoned joint policy that will be based on a realistic evaluation of the dangers and of the alternatives.

7. We should also bear in mind the severe economic and technical constraints that limit the development of such a relationship. Up to a point, Soviet gas has definite advantages for the Europeans: the extraordinary reserves, thick reservoirs, and large per-well flow rates of the West Siberian gas fields mean low drilling costs and abundant supplies for some time to come, while alternative sources lie underneath OPEC oilfields or have comparable disadvantages. Nevertheless, because of the transport costs Soviet gas and electricity exports will always be high-priced commodities, and the Soviets' own internal fuel needs are so large that they will always compete with exports. Similarly, Soviet imports of energy-related technology are likely to be held within relatively modest bounds by the Soviets' limited sources of hard currency and the many competing demands for it, such as the continuing need to import foreign grain. It is unlikely, therefore, that the Soviet Union could afford to finance a West European bail-out of the Comecon nuclear program, even though

⁹ Jean-Michel Quatrepoint, "L'accord entre Thomson et l'URSS," *Le Monde*—Oct. 21, 1981, p. 1. See also East-West Fortnightly Bulletin, No. 279 (Oct. 28, 1981), pp. 1-2. It seems likely that the Thomson deal will come up again at the next meeting of the Franco-Soviet "Grande Commission" on trade, which will take place in Moscow on Dec. 14 and 15.

¹⁰ V. Sevastianov, *Sotsialisticheskaya Industriya*, Oct. 4, 1981.

¹¹ These problems with technological innovation, and their implications for Western policy on technology transfer, are discussed at greater length in Gustafson, "Selling the Russians the Rope? Soviet Technology Policy and U.S. Export Controls," R-2649-ARPA (Santa Monica, Calif.: The Rand Corp., 1981).

¹² G. P. Bogomiakov, "Tiumentsy na vakhte piatiletki," *Dkonomicheskaya Gazeta*, No. 34 (August 1981), p. 5.

all the signs point to serious delays in nuclear power construction and to the prospect of electricity shortages throughout Eastern Europe.

8. By focusing as much as we have on the Urengoy-West European pipeline, we have tended to overlook the equally large quantities of pipe the Soviets have been purchasing all over the West for the rest of their pipeline network. The deals involved are individually smaller than the pipeline that has claimed so much of our attention, but probably amount collectively to an even larger sum. Such a degree of dependence on the part of the Soviets suggests that the West Europeans and the Japanese are not without leverage of their own, which they might use more effectively in the future than they have to date. While Soviet energy policy will not stand or fall as a result of Western actions (and one of the strengths of the OTA report is that it documents this point carefully), Soviet needs for "low-technology" assistance, particularly pipe and compressors, are severe enough that a tougher and more concerted approach on the part of the West Europeans and the Japanese would get them better terms, creating at the same time precedents for joint counteraction in case of Soviet energy blackmail. Such a common front by the Soviet Union's major Western trading partners, eliminating the preferential conditions granted to the Soviets in the past and lessening the diplomatic leverage available to the Soviets, could only be welcomed by the United States.

Mr. GORE. Thank you.

We will withhold questions until Mr. Hewett has completed his statement. Mr. Hewett, welcome to you. Please proceed.

Mr. HEWETT. Thank you very much, Mr. Chairman, for this chance to address the subcommittee. I should say in introduction to my remarks I am involved in a rather large project at the Brookings Institution on energy and national security. My particular project is on Soviet energy and the question I am addressing ultimately is if energy problems in the Soviet Union might become severe enough to push them to do something in the Persian Gulf which is one of the issues we have been discussing today.

And in my remarks here as opposed to my written testimony I will discuss that briefly as I go along.

The significance of energy to the Soviet economy is of two sorts, both economic and political. On the economic side, it provides inputs to industry, but it is also the major source of Soviet hard currency. In 1980, about 80 percent of the U.S.S.R. merchandise trade dollars were from gas and oil alone. That is up from a few years ago and reflects rapid price increases of those commodities but also the importance of energy in the Soviet Union.

The political part I don't think is understood quite as well in the United States. Those shipments of 80 million tons of oil to Eastern Europe go at prices that are about half the world market price right now.

In 1980, the Soviets were giving Eastern Europe a subsidy of about \$10 billion. They would have had to increase exports by 50 percent to buy that oil at world prices. It is also true that in one year if the Soviets could have charged Eastern Europe the full price for energy, they—the Soviets—could have liquidated their debts to all Western countries.

It is a subsidy that the Soviets are trying to reduce without a great deal of success. The current consensus among people who work on Soviet and Eastern European energy is that the Soviets will certainly be a net exporter of energy and oil throughout the 1980's.

On the other hand, there is a growing concern certainly in the Soviet Union, and I think in the West, that the Soviets will not be able simultaneously to meet the economic and political objectives

that they have been able to meet in the seventies with the energy exports.

They will have to choose between earning hard currency and giving subsidies to Eastern Europe and that choice which they are in the process of making now is going to create tensions in relations with Eastern Europe.

The increased tension between the Soviet Union and Eastern Europe are I think a major source of concern and present for the United States some potentially important issues because the tensions between the Soviet Union and Eastern Europe could easily spill over into East-West tensions.

Briefly, let me summarize the results of my research to date on Soviet energy balances and the implications I see for those for Soviet hard currency earnings.

Energy balances into the mid-1980's must be assessed both in terms of what we think the prospects are for Soviet energy supplies and also for Soviet energy demands.

On the supply side, Soviet production plans are modest by previous standards, and yet they will probably still not fulfill those plans. They plan to increase energy output at about 3.5 percent per annum through the mid-1980's and I predict they will more likely hit about 2 percent. Gas plans are an extremely important part of this. In fact, gas really represents the total net increment to energy they are likely to have up into the mid-1980's.

On the demand side, the Soviet Union, unlike many Western countries has really not been able to reduce the growth rate of energy demand relative to GNP and I see no reason for their being able to have new successes along this line in the near term. Right now, a 1-percent increase in GNP in the Soviet Union increases the demand for energy about 1.25 percent. Those were rates that we were used to in Western countries in the 1960's and early 1970's, but Western energy-GNP elasticities have fallen considerably.

My supply and demand projections together suggest that the Soviet Union will, by the mideighties, be able to export just enough oil for Eastern Europe, but no oil to Western countries, to Eastern Europe and Cuba.

It will have sufficient gas supplies to handle its own demands and export to Eastern Europe a slightly larger amount than is now being exported, and export to Western Europe about double what is now exported. In short, the Soviets can just about fill up the new pipeline for which they have made contracts.

The interest of your hearings here is really very much focused on East-West trade and let me speak to the implications about these energy developments for East-West trade and particularly how East-West trade interacts with them for a minute.

For the Soviet Union to realize the 2-percent growth rate per annum that I have projected, gas is the critical element in their supply plans, I might point out here that the Soviets are planning to build six large pipelines, only one of which is the West European line that has been discussed here. The problem in building those pipelines has, I think, been quite accurately portrayed in the OTA report and by Thane Gustafson as one involving both equipment and organization.

In terms of the equipment, I think the estimates in the West about the cost of the equipment the Soviets will need to import for these pipelines are far too high. The estimates of \$15 billion in hard currency costs for the Yamal pipeline, I think, is probably about three times what the hard currency cost of the Yamal line will be and I will be glad to discuss in some detail if you wish, as to why that is the case.

If instead of going from the credit side, you go from the equipment side and figure out what it is going to cost in current prices for the Soviets to buy that equipment, I think the entire gas expansion plan in the Soviet Union, the six big pipelines 20,000 kilometers in length, will cost them in hard currency more than \$20 billion.

They will need to make these expenditures over the next 5 years. They will need to borrow the money for it and the question becomes when they begin to repay those loans in the later part of the eighties how much they will have left over as net receipts for dollars.

Let me try to at least give you one prediction along that line. I think that by 1985, the Soviets will be exporting to Western markets something like 80 billion cubic feet of natural gas. They are exporting now about 25. From that gas as far as I can tell from the conclusion of the negotiations they will be earning a price which will give them gross receipts of about \$10 billion in 1985.

If I am right about the \$20 billion cost of this and other pipeline expansion program, they will be paying principal and interest in the mideighties of about \$3.5 billion, which leaves them about \$7.5 billion net.

Now, let me put that in some perspective. Last year, the U.S.S.R. earned from oil and gas about \$15 to \$17 billion. In 1985, if they are earning \$7 billion, given the rate of inflation, that is about the equivalent of \$5 billion or \$6 billion today. That is no catastrophe for the U.S.S.R. It gives them much lower hard currency earnings than they have had in the later part of the seventies but in the later part of the seventies they were lucky.

If you compare the mideighties to the midseventies, they are about back where they were. I would say, on the other hand, that this assumes that they are not going to increase energy deliveries to Eastern Europe. I have done a good deal of work on the East European energy balances and I don't see how if Eastern Europe cannot get increased deliveries from Soviet Union they can avoid decreases in living standards and some of the political and economic problems that will come from those.

Finally, let me comment just briefly about our policy options regarding Soviet energy development. I am in complete concurrence with the OTA report that there isn't much we can do one way or the other to effect Soviet energy developments.

In part, this is because the technology that they need to push their gas industry is freely available. Midlevel technology without obvious dual uses can easily be obtained in numerous Western markets. The credits they need to buy that technology are easily available or at least with relative ease assuming the political situation does not deteriorate considerably.

Second, most of the determinants of the success or failure of Soviet energy programs are internal. That is, they have to do with the things Thane Gustafson talked about. The Soviets themselves will determine their own energy future. They have done fairly well at it in the past and probably will manage to muddle through in the future.

In the particular case of the West European pipeline we made I think a terrible blunder there. We misunderstood the depth of the common political and economic interests which lay behind that line. And I think we also, in particular, misunderstood just how important the equipment exports were to the West Europeans.

When we went to Western Europe and offered alternative energy supplies, we didn't offer them alternative export markets for the pipe and the compressor stations and I think that was a major source of the current West European interest in the pipeline.

Finally, I would say that in discussions of the consequences of the pipeline, we should not forget for a moment the mutual interdependence involved in this line. While it is true that in Western Europe this increases somewhat their dependence on energy from the Soviet Union, on the other hand, it is a massive increase in the Soviet dependence on a pipeline for much of their hard currency proceeds. It could well mean that most of their hard currency in the eighties will be a function of one or more of a set of pipelines. The Soviets could not have wanted to have happened; they are into this because they had no choice. Their oil problems pushed them this direction.

It means that they are going to be extremely reluctant to cut off those gas exports for any but the most serious provocations from their point of view.

I think we must in this Government and this administration try to formulate our policy on energy in the context of a general policy toward East-West trade and I am sure you will agree with me on that. And in the process of doing that, we must become much more sensitive to the coincidence of Soviet interest with those of Western Europe and Japan and we must be much more aware of our own limitations so that we do not continually shoot guns with no bullets in them.

Thank you.

[The prepared statement of Mr. Hewett follows:]

PREPARED STATEMENT OF EDWARD A. HEWETT

INTRODUCTION

Not unlike leaders in many industrial countries, Soviet leaders are faced with a long list of very difficult political-economic problems which even in the best of circumstances mean that Soviet economic performance in the 1980's will be the worst it has been in the post war period. Within the Soviet Union demographic problems, a secular decline in productivity growth rates, and continuing difficulties in agriculture will probably keep the GNP growth rate below 3 percent per annum. Barring the very unlikely event of a quick resolution of U.S.-Soviet strategic arms issues, Soviet military expenditures shall have to grow faster than GNP; and consumption and investment shall suffer, with possible economic and political consequences.

In the remainder of the Soviet empire economic prospects are no better. Eastern Europe is only now initiating serious attempts at adjustment to an energy-expensive world, an adjustment they must make in the face of a Soviet refusal to increase exports of key industrial materials at subsidized prices. What must worry the Soviet leaders the most is that these adjustments will at best cause East European living

standards to stagnate—they could well fall, and therein lies a substantive risk to political stability in Eastern Europe.

In addition to these difficulties in the economy and the empire, yet a third set of problems surround Soviet economic, and particularly political, relations with the West. In the last few years U.S. defense policy and U.S. foreign policy have taken a turn unanticipated and unwelcomed in the U.S.S.R. Now in their calculations on how to deal with problems in their domestic economy and in the empire, Soviet leaders must factor in a new element which they perceive as a resurgent military threat from the West, led by the United States.

Soviet energy prospects are a common thread interconnecting these three problem areas—the Soviet economy, the Soviet empire, and East-West political-economic relations. For the Soviet economy, energy plays a critical role, not only as an industrial input, but also as a source of approximately three-fifths of all the dollars the Soviet Union earns from its merchandise exports. Those dollars are important to the Soviet economy, providing food imports necessary to sustain current living standards and machinery imports useful in increasing industrial productivity, including productivity in the fuel industry.

In the Soviet empire, particularly the critical arena of Soviet-East European relations, energy has been a key Soviet export for two decades. In the period following the OPEC price increases Soviet energy export prices to Eastern Europe have lagged far behind those prevailing on world markets, so much so that in 1980 Soviet oil exports to Eastern Europe sold for an average of approximately half of the world market price. The Soviet Union would like to considerably increase those prices (and reduce the subsidies) to free up oil for much-needed dollar earnings. Yet they are seriously constrained by the quite justified fear that a major increase in Soviet oil export prices to Eastern Europe would create economic difficulties in that region which would almost certainly generate political problems. In the near term Soviet energy and economic problems are likely to be such that pressures on Eastern Europe will grow, not diminish, and that increases the likelihood of serious political-economic problems in that region.

The general state of East-West political and economic relations can be influenced by, and in turn can influence, all of the above factors. Economic problems and political unrest in Eastern Europe will tend to increase U.S.-Soviet, and possibly West European-Soviet, tensions. On the other hand Western loans and equipment sales to the U.S.S.R. now in exchange for gas in the mid 1980's could contribute to releasing some tension in the entire system by alleviating some of the pressure on Soviet energy balances, which could alleviate some of the Soviet pressure on Eastern Europe.

Therefore, while energy is not the key to near-term prospects for Soviet economic performance, Soviet-East European relations, and East-West relations, it is certainly an important variable determining how each of those areas will develop and interact in the future. This testimony explores the prospects for Soviet energy and the policy issues we in the U.S. face regarding those energy prospects.

SOVIET ENERGY PROSPECTS FOR THE NEAR TERM

I shall focus on Soviet energy prospects into the mid 1980's, since that represents the time period for which we have a fairly large amount of data, and also because the next few years are critical for the Soviet economy. The important issues here concern Soviet energy supplies and Soviet energy demands, the difference between those being exportable energy; and I shall discuss each individually.

Prospects for Soviet energy supplies

Soviet primary energy production in 1980, and official plans for 1985 are the following:

	Actual 1980		Planned 1985		Increment 1985-80
	Natural units ¹	Mtoe ²	Natural units	Mtoe	Mtoe
Petroleum.....	603	603	630	630	27
Natural gas.....	435	356	630	516	160
Coal.....	716	350	770	376	26
Nuclear.....	73	15	³ 220	46	31

	Actual 1980		Planned 1985		Increment 1985-80
	Natural units ¹	Mtoe ²	Natural units	Mtoe	Mtoe
Hydro	184	38	230	48	10
Total ⁴		1,362		1,616	254

¹ Petroleum and coal are in million tons; natural gas is in billion cubic meters; and the electricity data are in billion kWh.

² Mtoe = million tons of oil equivalent.

³ This is an estimate since the final plan figures only give a joint figure for nuclear and hydro.

⁴ This excludes minor primary sources, for example, firewood and peat.

Source: Official Soviet data and plan documents.

The first and third columns of the table give data in natural units, while the second and fourth columns convert the data to million tons of oil equivalent (mtoe) in order to render them internally comparable. As the data show petroleum is, and will remain, the largest source of primary energy in the U.S.S.R., but natural gas is growing rapidly in importance. Coal is an important source of energy, but a stagnating one, and nuclear and hydro power are relatively insignificant energy sources.

The last column of this table illustrates just how critical natural gas is to the near-term energy prospects for Soviet energy. Of the planned increment of 254 mtoe of energy production during 1980-85, 160 mtoe, or about 63 percent of the total, will be natural gas. For coal and petroleum the planned increments are quite modest with planned levels for 1980 below what had been planned a few years ago for 1980. The planned nuclear increment is probably overly ambitious, but in any event nuclear is still such a small portion of the balance that shortfalls here are less important than for the conventional sources.

Whether or not these plans can be attained is in part a function of Soviet economic performance itself, and in particular a function of investment resources available in the context of what increasingly appears to be a very tight investment budget. While it is conceivable that Soviet planners could meet any one of these plans by devoting enough capital and labor to the sector, the important question is if they can simultaneously find enough capital and labor to meet the plans in all these sectors, while leaving enough left over to meet demands in other parts of the economy, including demands by the military.

Until and if more data on investment plans become available, it will be difficult to say how indeed this will turn out. It is clear that if Soviet planners are somehow forced to choose among the energy carriers, they will choose gas, at least in the near term.

The plans to increase gas production rest almost solely on plans to increase the output of the Urengoi gas field in Northwest Siberia from an output of 50 billion cubic meters (bcm) last year to an output of 250 bcm in 1985 (which is a change from 41 to 205 mtoe). They intend to do this by constructing six 56" gas pipelines—five primarily for domestic use and one for export to Western Europe—of a total length of 20,000 kilometers; and indeed construction of three of these lines (including the line to Western Europe) is already underway. There are no doubts about the enormity of gas reserves in the U.S.S.R., nor in particular are there any doubts about the Urengoi field itself, which at 6 trillion cubic meters, is among the largest gas fields in the world. The question of whether or not the 1985 plan of 630 bcm will be achieved is primarily a question of whether or not these lines will be put into operation on time.

There are two types of constraints with which Soviet planners must grapple in their attempt to meet the gas plan: equipment and organizational. The equipment constraints relate primarily to the fact that the Soviets do not produce sufficient 56" pipe, nor the optimum types of compressors needed to keep pressure up in the pipes. This is a problem not just for the West European line, but for the five other lines, and as a consequence the implication of Soviet gas expansion plans is that they could be shopping on world markets for upwards to 160 compressor stations (of which 41 are for the Western European line) and 10 million tons of 56" pipe (of which 3 million tons is for the West European line). They will also need to purchase significant amounts of pipelaying equipment.

All of these items are easily obtainable on western markets, and the credits are available to finance Soviet purchases. Therefore this equipment constraint is one which can be overcome if the Soviets are willing to increase considerably, for a short time, their net debt to western banks. This assumes that East-West tensions do not substantially deteriorate (which, for example, an invasion of Poland could precipitate), for in that case credits could dry up.

The organizational constraint is much more serious because imports cannot assist the Soviets in overcoming it. Soviet plans call for laying the six new pipelines at a

pace more than twice that of previous years, something they intend to achieve in part by dramatically increasing the productivity of pipelaying crews. Under these general conditions of high pressure, and in the harsh climatic and geographical conditions characteristic of the starting sections of each pipe, it is important that pipelaying and other ancillary services be extremely well organized. But that is obviously not now the case, nor will it be in the near future. Soviet planners are encountering tremendous difficulties in coordinating new investments in Siberia for oil and gas. Of the many difficulties, those which seem most intractable relate to the unwillingness of Soviet industry to produce and deliver on time machinery and equipment appropriate to arctic conditions; inability or unwillingness of construction ministries to build infrastructural facilities important to supporting pipeline construction and operations; only a very modest utilization of modern modular construction techniques in compressor stations; and a severe labor shortage. While the Soviets themselves are fully aware of these problems, they have made no obvious moves which will deal adequately with them, and therefore it seems likely that pipeline construction will proceed behind schedule and therefore so will gas output. They will probably not meet the plan of 630 bcm by 1985, but rather are more likely to produce about 600 bcm.

It is also unlikely they will meet the plans for the other energy carriers. There is a growing consensus now that oil production is likely to stagnate, and that even the modest planned increase to 630 million tons is optimistic. A much more likely figure is somewhere around 585 million tons. Soviets are taking actions to reverse adverse trends in the coal industry, and they may achieve some success. Still, 750 million tons seems more likely than their 770, and all of the increment will be low calorie coal from West Siberia, which means that raw coal tonnage may rise, while coal output in mtoe equivalent stagnates. The nuclear program is probably too optimistic, and the OTA estimate of 200 BKWH seems more reasonable (instead of the planned 220) and is a more likely outcome. Finally, I shall assume hydro power develops as planned.

To summarize, 1980 Soviet energy production in the major primary energy carriers was 1362 mtoe; and official plans call for production in 1985 of 1616 mtoe, which represents an increment to energy production of 254 mtoe. In fact 1985 output is much more likely to be 1515 mtoe, an increment of approximately 160 mtoe. That total increment equals the increment in natural gas production, with the increments in hydro and nuclear counterbalancing the fall in oil; and with coal production stagnating in calorific terms.

If in fact plans are underfulfilled in this way it will be an unpleasant surprise for planners, but one which will unfold gradually over the entire five year period (as for example is occurring in the end of 1981 in the problems in oil and coal production). Whether or not this will dramatically affect export prospects cannot be ascertained until we discuss energy demands in the USSR over the same period, focusing on the possibility that plan shortfalls in energy production can be counterbalanced by successes in energy conservation.

Prospects for Soviet energy demand in the mid-1980's

By world standards Soviet energy usage is high, a point freely admitted by many Soviet economists, and one frequently remarked upon in the West. Furthermore energy use has historically increased at a faster pace than the growth of GNP; in recent years the energy-GNP elasticity (the ratio of percentage increases in energy use divided by percentage increases in GNP) has been about 1.25. Since 1973 Soviet leaders have engaged in increasingly intense efforts to curb the growth of energy demand, relying primarily on administrative measures and bonus schemes consistent with the current planning system. Only next year will wholesale prices for industry be increased. So far these measures have no visible effect on the energy-GNP elasticity, nor on the elasticities for particular energy carriers. The elasticity for oil (relative to GNP) has hovered around 1.5 until recent years when it rose, and that for gas has been about 2.0.

In fact it is unlikely that new policies within the existing Soviet economic system can do a great deal to suppress the energy demand growth rate. This is a system structured around the notion that the most important economic problem is to increase outputs, not to conserve on inputs. The rising energy/GNP ratio is in part a reflection of that institutional bias. Within such a system, price increases for individual products such as energy (and such increases are scheduled to take effect in January 1982) will have little effect; resources are not allocated through price, and in any event the core of the system is still focused on output growth. Administrative measures designed to encourage or mandate conservation without changes in the basic character of the system are also unlikely to have a major impact. Soviet eco-

nomic institutions are biased toward supply-side remedies (for example increases in the output of gas and nuclear power), and no matter how fervently planners wish they could also realize demand-side savings, they are unlikely to achieve that without admitting the need for significant system reform.

The only type of demand-related measure at which central planning is good is the large capital investment which can be decreed from above, of which the best example for the USSR is the impressive commitment to co-generation over the years. But there is virtually no hope that that sort of solution can operate in the USSR in the near term. First, some of the most logical measures of this sort have already been introduced (for example, co-generation). Second, further measures take a good deal of time and effort of a sort not yet evident in the system; third, and most important, for the current Soviet problems a demand-side solution of this sort would require scrapping a good deal of existing capital, and replacing it with domestically-designed, or foreign, capital which is more energy efficient. In the best of times Soviet enterprises tend to keep capital operating longer than is typical in the West. And now, in the light of the severe investment constraints characterizing the current five year plan (and the likely constraints for the remainder of this decade), an increase in the rate of capital depreciation seems even less likely to occur. Aside from this there are significant pressures in the USSR to increase the energy-GNP elasticity, two of the most important being the further increases in energy and refinery output (both highly energy-intensive activities), and the explicit plan to push forward with the mechanization of agriculture.

For all of these reasons it is highly unlikely that the energy-GNP ratio shall reverse its trend of recent years and fall by any significant magnitude. For projection purposes I shall assume it remains unchanged at its recent value of 1.25. To be sure within that magnitude there can, and probably will be, a great deal of gas for oil substitution. This will occur for all new electricity and steam capacity, and may well reach into old capacity through retrofitting; these types of operations central planning can handle very well.

In 1980 total energy consumption (including own use and losses, but excluding minor fuels) was approximately 1,160 mtoe, the remaining 202 being exports (of which 150 was oil, and most of the remainder was natural gas). If, as seems likely, the GNP growth rate over the 1980-85 period averages 2.5 percent per annum, and if the energy-GNP elasticity is 1.25, that implies energy demand in 1985 of 1,350 mtoe. If production is, as I have predicted 1,515 mtoe that year, then net exports can be 165 mtoe. Judging from forecasted pipeline completions, contracts in Western Europe, and a guess at increments to East European deliveries, total gas exports will be roughly 100 bcm (82 mtoe) by 1985. There will probably be no coal exports and only small electricity exports, so that oil exports come out about 83 mtoe.

The number 83 makes the prediction sound far more precise than it is, but the general trust of the argument is that the Soviet Union will be hard pressed to make any oil deliveries to the West by 1985, and indeed it will find it difficult to maintain oil deliveries to CMEA (including Cuba) at the 1980 level of 90 million tons. The only way the Soviets will be able to free up oil exports for western markets will be if they somehow manage to induce a massive change in East European energy balances, or in East European hard currency earning capabilities, or if they have major conservation successes in the USSR. None of these developments is remotely likely, and indeed a careful analysis of the East European energy situation suggests that it will be extremely difficult for Eastern Europe to avoid economic stagnation even if Soviet energy deliveries remain at their 1980 levels. If Soviet delivery levels fall below that of 1980, negative East European growth rates are likely.

THE IMPLICATIONS OF PROSPECTIVE ENERGY DEVELOPMENTS FOR EAST-WEST TRADE

Soviet energy developments will exert two major influences on East-West Trade in the near term, as well as having general consequences for the remainder of the decade. The most immediate and palpable effect of Soviet energy plans will be large West European and Japanese exports of gas pipeline equipment critical to the realization of Soviet plans to expand their gas production capacity. The Soviet gas pipeline system is to be expanded by 40,000 kilometers in the 1981-85 period, moving to a total length of 170,000 kilometers in 1985. Within this expansion, one-half will be six 56" pipelines and the compressors to go with them. It is here where most of the import needs will arise as the Soviets have had long-term difficulties in developing and producing in large quantities of 56" pipe and the 25 MW compressors most appropriate for the compressor stations along such a pipeline. The large-diameter pipelines will probably involve approximately 13 million tons of pipe and 160 compressor stations, each station with three 25 MW compressors in it. Assuming the Soviets can

produce some of the necessary pipe and can equip some of the compressor stations with a larger number of lower capacity Soviet-made compressors, it still is reasonable to project that it will be necessary to import about 10 million tons of pipe and 125 compressor stations. At current prices, imports of those two items should not total more than \$15 billion. Other equipment (for example pipelaying equipment, valves, and so on) will add several more billion dollars. The total hard currency cost of the entire pipeline expansion program is unlikely to exceed \$20 billion dollars (even allowing for 1981-85 inflation). This is a significant sum, but still far short of the estimates implied when people say that the West European line alone will cost \$10-\$15 billion. In fact the West European line itself is likely to cost no more than \$5 billion in hard currency. (This, of course, is not the total cost of the line since it excludes large labor and material costs which will be financed internally).

Assuming this high figure for equipment imports of \$20 billion during 1981-85, that is \$4 billion per year, means about a 20 percent increase over 1980 levels of Soviet imports from Europe and Japan. It also means an annual increment to Soviet net debt of \$4 billion, which means for this reason alone Soviet debt to the West would rise from its current \$10 billion to approximately \$30 billion by 1985. For an economy as large as the Soviet economy, and for an investment as promising as Soviet natural gas, such a debt figure seems reasonably within Soviet reach. Assume the loans are issued for repayments over ten years to begin in 1985, and the interest rate averages 7.5 percent. That implies interest payments beginning with the first loans in 1981, and rising to a maximum of \$1.5 billion in 1985, at which point repayments of \$2 billion (\$20 billion repaid over ten years) commence and go through 1994. Total principle and interest payments are at their peak at \$3.5 billion in 1985, and thereafter fall with the fall in interest payments. I emphasize that this is a high estimate. Total pipeline costs could well be 25 percent below this making maximum principle and interest in 1985 only \$2.6 billion.

The precise timing of increments of Soviet gas deliveries to Europe is still unclear. They are now exporting 25 bcm, and in 1984 they will begin to increase those deliveries, reaching at least 60 bcm by 1987 (due to the new West European line). Other pipelines now under construction might allow them to begin exporting all 60 bcm as early as 1985, if the West Europeans wanted to buy that soon. For purposes of this projection I shall assume that is the case; if full deliveries do not indeed begin until 1986-87, that does not significantly affect the results. As mentioned earlier, total gas exports in 1985 should be 100 bcm, so the 40 left over after Western European deliveries is assumed to go to Eastern Europe, which is up to 10 bcm from current delivery levels.

The critical question is what price the Soviets will obtain for their gas exports to Western Europe. The Ruhrgas agreement in effect determined that, and unfortunately the details of the complex formula involved are not public information. Based on press reports it seems that beginning in 1984-85 Soviet gas will sell at least for a price of \$31 per barrel of oil equivalent, which, assuming 7 percent world inflation between 1981 and 1985 is the equivalent of \$23.60 per barrel of oil equivalent this year. That is a lower price than the Soviets thought they could obtain, but the best they could manage in the face of a rapidly softening market for gas in Europe (and even then they are forced to accept cuts in the quantities sold to major customers).

At a 1985 price of \$31 per barrel of oil equivalent, which is \$217 per ton of oil equivalent, the 60 bcm of gas exports (49.2 mtoe) will yield dollar receipts of \$10.7 billion (1985) dollars. After principle and interest that still leaves about \$7.2 billion net receipts available for hard currency imports (grain and machinery).

From Soviet planners' point of view the prospect of such hard currency earnings is hardly reason for jubilation, but neither does it represent a catastrophe. In 1980 Soviet earnings from energy exports peaked at \$15-\$17 billion, when they constituted ⅓ of all hard currency earnings from merchandise exports. Net earnings from energy in 1985 would be about a third of that after adjustment for the inflation which will occur between now and then, which puts earnings from energy exports back into the magnitudes the USSR had in the post-OPEC, but pre-Iran, period. Soviet planners can make do with those earnings, although it will mean some very hard choices between food and machinery imports, and therefore between consumer satisfaction and increased productivity.

There is in this projection no hint of an energy and economic situation in the U.S.S.R. so bleak as to push Soviet leaders beyond their traditional conservatism (so evident now in their dealings with Poland) to contemplate military actions in the Middle East. Whatever action the U.S.S.R. may take in the Middle East, energy concerns seem unlikely as a major motivating factor.

U.S. POLICY OPTIONS CONCERNING SOVIET ENERGY DEVELOPMENTS

In the United States we are at the end of an unsuccessful attempt by the Administration to block the various agreements surrounding the part of the Soviet gas expansion plan involving an export line from Urengoi to Western Europe. The Soviets have already commenced construction on that line; and the pipe and compressor contracts apparently await final conclusion because of financial arrangements which are near resolution. In short, a key feature of Soviet energy plans involving East-West trade is in process of implementation over the very strong and vocal objections of the United States. This entire episode has simultaneously raised questions and offered answers about Soviet energy and East-West trade which deserve very careful study in the United States.

First it is obvious that Soviet plans for the gas industry expansion not only played a key role in Soviet plans for all energy supplies, they also were important elements in West European and Japanese leaders' plans for their industrial exports. The portion of the gas deal of most immediate appeal to Western Europe was the prospect of enormous pipe and compressor exports. The thrust of the Reagan administration's alternative plan (involving U.S. coal, nuclear power, and liquified natural gas) virtually ignored this critical element of the deal. We were pressuring Eastern European governments not only to ask some of their firms to give up the idea of buying relatively cheap Soviet gas, but more importantly we were asking these governments to tell other firms to give up huge export deals. And we were doing this in the wake of having ourselves removed an embargo on grain, a key U.S. export. Justifiably, West Europeans took our actions, not our words, as a guide, and they refused to consider the hastily drawn-up alternatives we offered them. The lesson in this for the U.S. Administration is that Eastern Europe and Japan have understandably strong economic interests in developing their export capacities to the Soviet Union and Eastern Europe. These are similar to the specific interests we exhibit concerning grain exports, the difference being that European interests span a far broader set of commodities, focused in manufactured goods. If we underestimate the strength of those economic interests, or the political lobbies which lie behind them, we risk a substantial (and further erosion) in our credibility concerning East-West trade policy.

Secondly, the major constraints on Soviet abilities to realize their energy plans are of two general sorts: (1) their ability to borrow funds and use them to buy primarily middle-level technology with no obvious direct military applications, and (2) the organizational issues discussed earlier. If all the western nations were to agree on credit or machinery export limits, then that would indeed significantly affect Soviet energy production in the next four or five years. But for the reasons just discussed such a policy is not possible, and to attempt to pursue it would probably do more harm to the Atlantic Alliance than it would do to the Soviet Union and Eastern Europe. In any event the more serious constraints are organizational, and in those the West can be of very little help, or at least it will not be asked to help. It is rather the internal dynamics of Soviet economic and political institutions which will determine the severity of this constraint.

In short there is very little the United States can do on its own to influence one way or the other the fate of Soviet energy plans. Our failure to stop the West European line illustrates the futility, and indeed the potential harm, of pursuing such a policy. It would be far more reasonable to concede the coincidence of Soviet and West European/Japanese interests on this point, and then work with our allies to ensure that the proper precautions are taken to minimize the potential harm which might attend a Soviet gas cutoff.

At the same time we should realize that the probability of such a cutoff is quite low. While much has been made of increasing West European dependence on the U.S.S.R. for energy, very little has been made of dependence of the U.S.S.R. on Western Europe for hard currency, although that latter dependence appears to be much stronger. If, as appears to be the case, by the mid 1980's the U.S.S.R.'s sole source of hard currency through energy exports is gas, then a cutoff becomes a very unlikely event. For the temporary chaos it would cause the Western Europeans if arrangements were made to increase gas production in the North Sea, switch dual-fired boilers to fuel oil, temporarily reduce use, and so on, for all of these temporary benefits, the U.S.S.R. would jeopardize its major source of hard currency earnings for the 1980's and 1990's.

Mr. GORE. Thank you very much. Thank you both.
Mr. Walker?

Mr. WALKER. Yes. Thank you very much for your testimony. I think you make a good point that there is a dual dependence on the line which comes from the development. How potent, though, do you think that the geopolitical threat is of cutoff? In other words, even though it might be acknowledged that the Soviets are very dependent upon the hard currency generated by putting gas into Western Europe, couldn't it still be a potent threat to be used in geopolitical affairs that we will, indeed, cut off the energy without actually affecting the option?

The hard currency continues to flow, but the threat can be used successfully in a bilateral negotiation or multilateral negotiation for that matter.

Mr. HEWETT. That is obviously the most legitimate concern one could have about Soviet energy. My answer is no, I don't think there is a high probability that could occur. The reason is that the Soviets are not just interested in gas but in developing a long-term relationship with Western Europe economically and politically. And even using the threat of that sort of action would seriously jeopardize their ability to develop yet higher levels of exports in the later part of the 1980's particularly since I think they are going to be coming back and trying to export even more gas and energy to Western Europe.

So the Soviets are rather clever at this. They take a fairly long-term view of their economic and political relations. I think they are better at it than we at times. In this regard, I don't see them for short-term gains jeopardizing that other than for very serious reasons.

Mr. WALKER. It is easier to take a long-term view when you don't have to run for reelection every 2 years.

Dr. Gustafson, you were going to make a comment.

Dr. GUSTAFSON. I wanted to add that your question pushes our thoughts in a very useful direction. There has been a tendency on the part of people in the administration, understandably enough, since they were concerned to head off the first deal in the short term, but there has been a tendency on their part to say once the barn door is open and the horse is gone, it is too late.

A new area has arrived of Western European dependence on the Soviet Union and the worst may follow. I think instead it follows from everything that has been said here today that there is a larger energy relationship in the offing or maybe in the offing and it will develop over a period of 10 or 20 years and consequently we have ample time to come up with a response policy, response menu of alternatives and options and suggestions for the West Europeans and in this context, the threat of Soviet blackmail is perhaps a useful spur for us to step forward and demonstrate to the West Europeans what the alliance really means by coming up with some thoughtful alternatives that commit us clearly on the side of the West Europeans in helping to provide for their energy security.

That can only be a step forward.

Mr. WALKER. I think that is useful. I guess my problem is that insofar as there is an opportunity, it also gives the Soviets an ability to undermine as well. That is part of the context in which I was asking the question.

Also, I think that the OTA report and what you have told us here today with regard to the hard currency needs of the Soviet Union is a valuable part of what we are trying to now develop in policy options within the administration. But I also understand that would be one of the factors that needs to be looked at is whether or not this doesn't make the Soviets then more dependent upon Western technology that you kind of move them away from research and development of their own.

They develop along the lines of our technology utilizing what we are willing to sell. I think that is useful. That is a useful point.

One concern I have on that, however, is how much of a look has been taken at their ability to leapfrog that technology as a result of not having to devote R. & D. dollars to that which they are able to buy from the West and therefore turn their attention toward leapfrogging us.

I just had a discussion here recently with some American technology people who are saying that we have no hope of competing with the Japanese on first generation robotics. Our real hope exists in leapfrogging and going immediately to second generation or perhaps even third generation robotics.

Now, if that is the case, what we are saying is we are going to allow the Japanese to sell their first generation robotics, but we intend to move technologically a couple of steps ahead because we don't have to do all the R. & D. that they had to do on that.

How does that then also apply to what we might be giving in terms of technological advantage to the Soviet Union?

Dr. GUSTAFSON. I can say a few words on that on the basis of a study that the chairman referred to earlier. I am referring to the report entitled "Selling the Russians the Rope."

In the course of that study, I reviewed what Western dollars have written on the past record of Soviet technological imports. I can't talk about the military area. This was a nonclassified study, and I have not had occasion to look at any other sort of material.

So, it may be that in the military area it is a different story, but in the civilian area the answer is quite clear that the Soviets have not used imported technology for the purpose of leapfrogging; or, if they intended to, they don't seem to have succeeded.

Instead, the pattern that comes out quite clearly is that the Soviets have imported large amounts of foreign technology—not high technology, but standard in-use technology, off the shelf—to give themselves a fast start in some area of policy in which they have traditionally been behind and which they have traditionally neglected and in which they want to make rapid progress for some policy reason of their own.

So, as recent examples, we have had agricultural chemicals, fertilizers, pesticides, or advanced chemicals. Synthetic fibers, advanced plastics, or automobiles have been another example of that same use of foreign imports to break free of the rigidities of the Soviet planning system enabling you to get fast off the mark in some area.

Now, that has not led to leapfrogging. The best study I know, for example, is Phillip Hanson's study of the Soviet pattern of imports of chemical technology. He has found that there has indeed been a pattern of dependence, perhaps not one that the Soviets expected

in advance or planned for, and that dependence has not lessened over time.

The Soviets have shown no success in moving beyond the technologies that they imported or even in freeing themselves from dependence upon them, and that seems to be the pattern.

Mr. HEWETT. Mr. Walker, if I might just add one word which is at least related to your question.

I think one of the misconceptions that I encounter sometimes in the United States about the Soviet Union is that they are importing this technology because they cannot themselves develop and produce it. Actually, those who have done careful work in the Soviet Union are impressed with the fact that many of their problems are not in research but development.

For example, the 56-inch pipe that they are importing they do produce themselves. They have now developed a laminar pipe that is quite capable of handling pressures above what they have in the Soviet Union and up to Western standards, but they can't get Soviet firms to produce it. The same thing with drilling bits. The same thing with compressors.

What they are doing now, and their imports accompany their energy program, is to try to compensate through imports not for problems in research but for problems in manufacturing.

Mr. WALKER. Let me go back for a moment to the question where we were pursuing a minute ago to the potential threat from supply interruption and ask some questions of a specific nature on that.

First, it seems to me that natural gas represents a particularly tough problem if you do have interruptions because it is something that you cannot replace easily. You can't store a strategic research of it the way you can with oil. You have very difficult times coming up with backups, and yet the kinds of things that you adapt natural gas to are the kinds of things that you can't very well use anything else for once you have got the natural gas mechanism replaced.

How much of a problem is that when you start talking about dependence upon a Soviet supply?

Mr. HEWETT. Well, I don't quite agree with the statement the way you put it. For underboiler uses, you can dual-fire those underboilers. In fact, many of the boilers are dual fired now so that they can be easily switched to low sulfur fuel oil in the event of a shut-off.

Second while it is true that households in West Germany and in the other European countries will be receiving in effect Soviet gas, they are not going to be hooked directly to the Siberian pipeline, but to the domestic gas distribution system in Western Europe.

My presumption, without having made a detailed study of this, is that the West Europeans in a short period of time could decrease low sulfur fuel and increase gas to take care of homes and get surge capacity up in some of the North Sea fields.

So, there are certain dual uses which are in fact why the Soviets ran into pricing problems on gas this time, because they ran into dual use commodities with low prices.

There is a way to redistribute gas around that whole system. The only problem you really have is in homes. If you have got a gas-fired heater, you have a gas-fired heater. You don't have a dual-

fired heater, but you can use your flexibility in industry to make sure the homes are heated.

Mr. WALKER. Of course, the question then becomes that Western Europe is extremely dependent on outside sources for oil, particularly low sulfur oil. In an emergency situation, if they were cut off, for instance, from Persian Gulf supplies and also had the vulnerability of the natural gas, then I have created an almost complete energy emergency in Western Europe.

Mr. HEWETT. Yes, sir, but if they are cut off from Persian Gulf supplies, they would have been in worse shape before. At least you have the possibility that gas will keep flowing from the Soviet Union. You are already in a bad situation. I couldn't think that makes it much worse.

If the Soviets coincidentally cut off gas, then you are in a situation that is an additional emergency anyway.

Mr. WALKER. It seems to me that it could be argued that Western European development to Soviet gas leverage could be much more substantial than numbers indicate.

Even without a cutoff of Soviet energy flows, the absence of an energy safety net for consuming countries, the Soviets would possess leverage which could be brought to bear on the Western government? Is that a correct statement? If so, what are we going to be able to do about it?

Mr. HEWETT. My feeling is that in part, because of the original U.S. objections to the pipeline, that the West Europeans who were already concerned about their increased reliance on Soviet gas became more concerned and that they have put into place, or are putting into place, a number of systems which would reduce the potential leverage the Soviet Union could threaten to use with natural gas.

Dr. GUSTAFSON. I would just like to add to that a few examples from the French case. The problem of dependence, of course, is not a new one as far as the French are concerned since they have been hit very high by the advent of OPEC and the spiraling price of oil. They have experienced cutoffs in the past. So, the French have been pursuing a very aggressive policy of nuclear power development.

The new government, although it has put a freeze on a few power plants and may be slowing down the rate of construction, nevertheless has reaffirmed the commitment of the previous government to nuclear power.

I am not very familiar with the technical aspects of the case, but I do know that Gaz de France is building underground storage as fast as it can for gas. In discussions of the subject, I have not seen the French experts show much doubt that they could store quite a bit of gas. They are running into some opposition, but that does not seem to slow them down much, either.

So, at least on the French side there does seem to be a considerable amount of concern of active programs underway that antedate the Soviet deal.

The Germans may be more of a problem. I am less familiar with the details, but even the Germans now are trying to get their nuclear program back underway. As Dr. Hewett says, I think the Germans have had to consider it more than the might have before.

Mr. WALKER. Let me look to another example and maybe have you comment on this because it seems to me that the one example that we have where there is some interdependence and perhaps where there is some interdependence that resulted in some differing policy options is in the case of Finland, where that interdependence has certainly resulted that in Finland, when you talk to their officials, they are fiercely independent. They do not want to be regarded as in locked step with the Soviet Union, but on the other hand will admit that, in fact, they cannot afford in any way to antagonize the Soviet Union either. That is based upon interdependence, some of which is in the energy area.

I guess that that is what I am concerned about when you take a look at Western Europe. Has a relationship in any of the studies been done between Finland and the potentials for Western Europe?

Dr. GUSTAFSON. I think your concern is absolutely on the right point. Another example is Austria, which has in recent years developed a very important commercial relationship with the Soviets. They have had some difficulties with that relationship. They have taken a loss in their trade with the Soviet Union.

The larger point that your questions lead to is that we must take very seriously the prospect of an economic community of interest arising between Western Europe and the Soviet Union which has not existed before, and that does challenge us to rethink the basis of our alliance with the Western Europeans.

If the pipeline serves the purpose of kicking us to do that, stimulating us to do that, then it will have served a very useful purpose.

Mr. WALKER. How likely is it that the agreements with the Western Europeans for gas deliveries will come at the expense of the Eastern bloc?

Mr. HEWETT. "Come at the expense" is a phrase—

Mr. WALKER. Well, let me ask this. Is it worth it or vice versa?

Mr. HEWETT. They are not going to cut gas exports to Eastern Europe because of this agreement. I am more concerned that they will cut oil exports to Eastern Europe because of internal pressures, and there are signs that they are doing that this year.

For gas exports to Eastern and Western Europe, I think what the Soviets found in the negotiations this year is that they have more gas to sell than Western Europe wants to buy right now because there has been a substantial decrease in projected gas demands in this market in the 1980's.

The Soviets went in wanting to sell at least 40 BCM at about \$25 a barrel of oil equivalent. They came out with something like \$22 a barrel and maybe 35 BCM. So, the problem is not making a choice from the point of view of Eastern and Western Europe in terms of scarcity.

On the contrary. The problem is earning the money they thought they could for the gas they are going to export.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. GORE. Thank you.

Dr. Gustafson, your testimony, like the OTA report, gives several possible scenarios for what may happen with respect to Soviet energy development. You say, "We have no precise way of knowing the relative likelihood of the possible futures for which we are trying to design a policy."

In spite of that uncertainty, do you believe as of now that the Soviets will have an exportable energy surplus in the 1990's?

Dr. GUSTAFSON. Mr. Chairman, I am not competent to answer that question in the same succinct way that you have posed it. I am a political scientist rather than an oil expert.

Let me say only one thing that I am very impressed by, which is that if you follow the Soviet leaders' speeches on energy and the evidence of resource allocations, two things stand out. One is a certain hesitation on the Soviet leaders' part in approaching the energy question.

They first became aware in the early seventies that they had a potential problem on their hands. They began by considering a large gas strategy as early as 1974. Then by 1975 and 1976 they appeared to switch to coal as the avenue of the future.

Then in late 1977 Brezhnev abruptly appeared to take over control of energy policy and swing the direction of policy toward West Siberia, beginning with oil. Then in late 1979 there appeared to be a return to a more balanced energy strategy and then by 1980 the new stress on gas.

It is hard to say what this pattern of hesitation means. It suggests that the Soviet leaders themselves may be no more certain about the answer to your question than anyone in this country is.

The other thing that stands out is that despite this zigzag pattern, the overall course of policy has been toward greater and greater stress in the Soviet leaders' speeches on energy.

If you compare what Brezhnev had to say at the last party congress in 1976 with what he had to say in 1981, just the amount of time he allocated to the problem makes the point. He had very little to say about energy in 1976. In 1981, that came first.

Again, political commitment is the key to success in such large endeavors, or at least the necessary condition for success. That, at least, is one thing that has changed in the last 5 years. The leaders are aware of the problem, and it is uppermost in their minds.

Mr. GORE. The awkwardness of their system prevents or may prevent the translation of that political commitment into a coherent strategy for accomplishing the goals to which they are committed.

Dr. GUSTAFSON. Absolutely right. I think another theme to be stressed at this point is the crucial importance of timing. After all, the CIA's own case really turns on matters of timing.

If you accept the essence of the CIA's case that there is going to be a trough in Soviet oil production, if you allow for certain delays in the growth of gas output, it is quite conceivable that the Soviets could be left with a dip in overall energy production in the mid to late eighties, even if the CIA scenario of a collapse does not actually come about.

Mr. GORE. Mr. Hewett, your estimate of the cost of the pipeline of the west Siberian pipeline is what? You expressed it in two different ways. Help me understand, if you would.

Mr. HEWETT. I think the hard currency costs of just the West European pipeline will not exceed \$5 billion.

Mr. GORE. What about the entire project?

Mr. HEWETT. I can't answer that. The problem is what Ronnie Goldberg mentioned; that is, that we really don't know fully the

ruble costs involved in all of the infrastructure, labor and so on and if we did, it would be hard to get those into dollars.

I am simply giving you the hard currency part of it, which is the nuts and bolts. I emphasize that I am not a specialist on nuts and bolts of pipelines, but one can go to open sources and find costs of pipe and you know how much pipe they are going to need and compressors and you know how many of those they are going to need. It comes out under five.

Mr. GORE. Are there any changes in the IEA agreement, the International Energy Agency agreement, that we should think about as a result of the impending use of Soviet gas by Western Europe? That is one of the questions I had hoped to address to the administration witnesses, but I wonder if you have any thoughts on that?

Mr. HEWETT. I have no special competence on that.

Mr. GORE. All right. Well, we will wait for another hearing to pursue that.

I would like to thank you both for really excellent testimony and the work that you are doing in this area. I believe if we better understand what reality is that we are confronting, we will be better able to fashion a sensible policy.

Thank you both very much.

Dr. GUSTAFSON. Thank you, Mr. Chairman.

Mr. GORE. Our final panel today consists of Mrs. Miriam Karr, vice president of Chase Trade Information, Corp., Inc. in New York, and John Garrett, manager for business research with the Gulf Oil Exploration & Production Co. in Houston, Tex.

If you two would make your way toward the witness table, we would appreciate it.

Mrs. Karr, you are accompanied by Roger Robinson, also with Chase Manhattan; is that correct?

Mrs. KARR. That is correct.

Mr. ROBINSON. I am with the Eastern European Banking Division of Chase.

Mrs. KARR. Do you wish me to start?

Mr. GORE. Yes. Without objection, the entire text of the prepared statements will be put into the record at this point.

We would like you to begin, Mrs. Karr. Welcome.

STATEMENT OF MIRIAM KARR, VICE PRESIDENT, CHASE TRADE INFORMATION CORP., INC., CHASE MANHATTAN BANK, NEW YORK, N.Y., ACCOMPANIED BY ROGER W. ROBINSON, EASTERN EUROPE BANKING DIVISION, CHASE MANHATTAN BANK; AND JOHN GARRETT, MANAGER, BUSINESS RESEARCH, GULF OIL EXPLORATION & PRODUCTION, HOUSTON, TEX.

Mrs. KARR. Thank you. Mr. Chairman and members of the committee, it is a privilege to appear before you to discuss some of the policy considerations pertaining to East-West commercial relations, particularly those relating to energy resource development in the U.S.S.R.

My testimony will primarily touch on issues relating to the role the United States could play in promoting a unified Western policy governing strategic trade.

I would like to point out at the outset that I am appearing before the committee on my own behalf and that the views expressed in my testimony and in any subsequent discussions are my own and do not necessarily reflect the views of the Chase Manhattan Corp. or Bank.

Since 1973 my associate, Roger Robinson, and I have been closely following the evolving pattern of East-West trade, particularly in the area of resource development projects in the Soviet Union.

In a report analyzing the Urengoi-Yamburg gas transmission project, currently featured in the Washington Quarterly under the heading "Soviet Gas: Risk or Reward?" we made an effort to put forward a conceptual framework within which long-term strategic trade arrangements, such as the Siberian pipeline, should be treated.

We selected this particular project because it embodies most of the important unresolved policy issues associated with Western participation in the extraction, processing and transmission of Soviet energy sources.

We support the concept of a global approach to the development and utilization of energy resources, including those of the U.S.S.R. However, such an approach hinges on developing a framework for furthering Western energy security. This entails the careful selection and priority ranking of those resource locations offering the most stable long-term supply, so as to achieve a balanced diversification of supply sources.

It is, therefore, appropriate to pose the question, is the unprecedented scale of Western involvement in the Urengoi-Yamburg pipeline—which will claim equipment, technology, and capital valued at about \$15 billion, with a total project cost estimated at \$45 billion—justified in terms of an optimal global strategy for the allocation of Western capital and equipment resources.

For instance, efforts are currently underway to mobilize support for a Western gas development project of near identical stature and proportions; namely, the 4,800 mile Alaskan Natural Gas Transportation System, ANGTS, which is designed to move 26 trillion cubic feet of gas from the Prudhoe Bay field at the rate of 2 billion cubic feet a day. The total cost of this project, when completed, is put also at about \$45 billion.

Without suggesting that the Alaska pipeline can serve as one of the near-term alternatives connected with Urengoi-Yamburg, this North American venture should be viewed as a practical opportunity to demonstrate our commitment to Western energy security. This could be accomplished by the United States creating an environment which would encourage our Western allies to play a role in the development of these resources and to participate in the future sharing of energy supplies. Canadian gas producers have already formalized agreements with Japanese gas utilities for the sale of 400 million cubic feet a day of liquified natural gas to Japan over a period of 20 years. Offers for Canadian LNG have also been put forward to West European gas distributors.

The object lesson to be drawn in the aftermath of the Urengoi-Yamburg debate is the vital need for the formulation of a consistent and comprehensive Western policy that would facilitate the orderly development of future strategic economic relations with the

U.S.S.R. Although the United States can no longer exercise effective unilateral control over technology transfers to the U.S.S.R. in the energy field, it can nevertheless play a constructive role in shaping a multilateral policy structure among Western suppliers of energy equipment and technology.

However, the United States first needs to lay the basis for a consistent national policy covering strategic trade with the U.S.S.R. Since 1978, U.S. export controls relating to energy hardware and technology were largely based on sporadic ad hoc decisions. Moreover, there has been a lack of consistency in such areas as grain trade and industrial technology. This in turn highlights the need for tighter coordination among the various Government agencies—such as State, Defense, Treasury, Commerce, Agriculture, and STR—that are directly involved in the process of policymaking and implementation. As broader geopolitical considerations are essential components in formulating such a national policy, perhaps the most appropriate means of assuring consistent implementation would be the creation of an Interagency Office for Strategic Economic Relations, with the Department of State functioning as the coordinator.

An interagency policymaking body of this kind would have the dual advantage of providing a better platform for the construction of a unified Western approach to economic relations with the U.S.S.R., and at the same time enhancing the stability of East-West commercial relations. The latter would particularly benefit U.S. business, which in the past has often been hampered in pursuing business opportunities in the Soviet market by erratic "go-no-go" government decisionmaking.

West European nations and Japan have traditionally followed a policy of expanding commercial relations as a means of providing incentives for greater geopolitical cooperation. An important flaw of such an approach, however, is the danger that prospects of substantial commercial gains often obscure the political risks inherent in such long-term undertakings. This vulnerability is a particularly significant factor in relations with the Soviet Union, which tends to translate long-term economic dependencies into political leverage to advance their own geopolitical objectives.

The United States, on the other hand, cannot be guided solely by commercial considerations in its economic relationship with the Soviets. As the leading partner of NATO, the United States must make dispassionate assessments of the geopolitical realities that surround any Western long-term strategic trade arrangements. Overcoming these fundamentally different perspectives represents the primary challenge in efforts to forge a unified Western policy.

As an institutionalized framework is also best suited for this task, it is appropriate to evaluate the capabilities of already existing Western institutions. In our view, the most logical framework would be the underutilized economic Secretariat within NATO. If upgraded to the same stature as the organization's military and political secretariats, the principal mandate of this restructured entity would be to candidly review and assess the risks inherent in projects such as Urengoi-Yamburg, and to establish priorities for developing global resource locations providing the securest long-term supplies.

Finally, should the United States deem it appropriate within the context of its defined policy to actively participate in the development of Soviet resources in partnership with Europe and Japan, then it must also provide an export support infrastructure similar or equivalent to those available to European and Japanese equipment and technology suppliers. This would place U.S. companies on an equal footing with their Western counterparts.

Thank you, Mr. Chairman.

Mr. GORE. Thank you very much for an excellent statement.

Without objection, the article entitled "Soviet Gas: Risk or Reward?" which you and your colleague, Mr. Robinson, coauthored for the Washington Quarterly, will be put into the record at this point.

[The Washington Quarterly review follows:]

[From the Washington Quarterly, autumn 1981]

SOVIET GAS: RISK OR REWARD?

(By Miriam Karr and Roger W. Robinson, Jr.)

In lifting the U.S. grain embargo imposed by President Carter in January 1980 in response to Soviet intervention in Afghanistan, the administration added a new dimension to the already complicated dialogue between the United States and Western Europe concerning relations with the Soviet Union. At a time when the United States is urging Western Europe to adopt a more vigilant cautious posture towards the Soviets on a range of policy issues—from the deployment of new Euro-strategic weapons to entering into long-term resource commitments—the administration's decision to terminate the embargo earlier this year may have temporarily weakened U.S. leverage in effecting a consensus on these and other critical issues.

Nevertheless, the opportunity for the United States to use the grain issue to forge a more consistent and unified Western approach towards the U.S.S.R. has not been lost. Because of divergent views within the administration concerning the grain trade issue, the United States decided to defer negotiation of a new long-range grain agreement, probably calling for a higher ceiling on future purchases of U.S. grain, and agreed instead to extend the existing arrangement until the fall of 1982. Although this move may have deprived the administration of the opportunity to negotiate within the context of an anticipated third consecutive poor grain harvest in the U.S.S.R., the deferment may eventually result in greater Soviet willingness to reach accommodations on a broader range of East-West issues prior to a U.S. commitment to improved cooperation on this and other strategic trade questions. Given the priority attached to the U.S.S.R.'s livestock program and continuing shortfalls in domestic grain production, the forthcoming grain negotiations should provide an opportunity for a significant give-and-take.

The importance of U.S. adherence to a consistent policy towards the U.S.S.R. regarding grain is underscored by a parallel development dominating West European-Soviet commercial relations, namely the joint construction of a new Siberian natural gas transmission system. The projected new pipeline, which Soviet officials describe as the "largest project in recorded history," and U.S. grain exports are the two pivotal trade issues in East-West economic relations. The Soviets view these issues as important underpinnings of their overall foreign policy strategy towards the West. The Western allies should therefore coordinate these central economic issues at the highest level rather than continue the past practice of ad hoc, discontinuous, and at times low level treatment.

Since the controversial U.S. grain sale to the U.S.S.R. in 1973, the grain trade question has sporadically been elevated to the status of a major policy issue in overall U.S.-Soviet political relations, triggering exhaustive public debate. However, it is interesting to note that the large gas-for-pipe compensation arrangements between Europe and the U.S.S.R., dating back to the late 1960s, have never been openly discussed in political terms in this country. The new Siberian gas pipeline, however, represents a watershed event in this series of major resource compensation transactions and, due to its massive proportion, remains a hotly contested public issue in Europe. The major political implication raised is whether the pipeline venture would lead to an imprudent degree of dependency on Soviet gas resources. Whole-

hearted U.S. support for a more unified Western stance on economic as well as political issues dictates that the dependency question be viewed with equal or even greater concern on this side of the Atlantic.

The administration's attention to the project was reflected in its decision to place this issue high on the agenda of the Western economic summit in Ottawa in July. Prior to the summit, congressional resistance to the project began to take on momentum after some 50 members of Congress conveyed their serious concern in an open letter to President Reagan. This was followed by the introduction of a resolution in the House of Representatives opposing U.S. participation in the project and urging the president to establish allied cooperation in developing Western energy alternatives. A companion resolution expressing similar views was scheduled to be introduced in the Senate in September by Senator Jake Garn (R-Utah).

Originally, the proposed 3,600-mile gas transmission system was to extend from Yamburg, a new gas field discovered in 1969 on the Taz Peninsula in the Yamal Arctic region of western Siberia, to the western border of the Soviet Union. Soviet industry experts, however, recently decided not to proceed with full development of the Yamburg field in the current five-year plan, but rather accelerate the expansion of the huge Urengoi field that has been producing gas since 1978 and is located 150 miles to the south of Yamburg. Urengoi gas production is slated to increase from 50 billion cubic meters in 1980 to 240 billion cubic meters in 1985. Moreover, Soviet gas specialists claim that this shift in gas exploitation strategy would result in a potential cost saving of an equivalent ruble amount of \$1.3 billion. The need for reappraisal of optimal cost effectiveness of gas exploitation becomes more evident in light of a planned 100 percent increase in Soviet investment expenditures in the gas industry during the period 1981 through 1985 to an equivalent of \$26 billion.

Nevertheless, as the Soviets bring the Yamburg field on stream during the later stages of the delivery schedule, Yamburg will become a major source of gas for the project. Therefore, it remains practical to refer to the proposed pipeline as the Urengoi-Yamburg project.

At the 26th Communist party Congress in February 1981, President Leonid Brezhnev reiterated that the opening up of western Siberian gas resources and their transmission to the European part of the U.S.S.R. is the centerpiece of Moscow's energy program extending up to 1990. Considering the hard currency earning potential from western Siberian gas sales, the economic rationale of Moscow's stated energy policy is indeed compelling. The anticipated \$10 billion to \$15 billion annual earnings from Urengoi-Yamburg and other gas revenues from new pipelines expected to be operational in the mid-1980s assume even greater significance at a time when income from oil exports is leveling off. The new Soviet five-year plan reflects this shift in emphasis from oil to gas by projecting a dramatic rise in gas production from 435 billion cubic meters in 1980 to 600-640 billion cubic meters in 1985. During this period, even according to Soviet figures, the U.S.S.R.'s oil output is expected to peak at 620-645 million tons, or only marginally more than the 603 million tons that were produced in 1980.

The sluggish expansion of Soviet oil output is primarily due to bottlenecks in exploitation of new oil fields located in harsh permafrost regions. To support the prodigious investment involved in Soviet resource development, the Kremlin leadership is actively promoting large-scale compensation deals, such as Urengoi-Yamburg, which not only lock in substantial earnings over time but also provide the benefits of much needed infusions of Western equipment and technology.

The new pipeline is intended to supply 40 billion to 70 billion cubic meters of natural gas a year to 10 European countries—West Germany, France, Italy, Austria, Finland, Belgium, the Netherlands, Sweden, Switzerland, and Greece. A consortium of European companies, led by West German concerns, are in advanced stages of negotiation with the Soviet Union for the supply of large diameter steel pipe, gas compressor stations, pipelayers, and other equipment valued at about \$15 billion. Included in this figure are Japanese contract negotiations for similar equipment worth close to \$3 billion. Interestingly, Japan's participation as a supplier to Urengoi-Yamburg represents a significant departure from other involvements in Soviet resource development projects which are tied to some form of payment in end product.

Some large U.S. manufacturers have also been invited to bid on equipment contracts, however, the potential level of American involvement in the project is yet unclear. Although the administration has approved a recent sale of U.S. pipeline equipment to the U.S.S.R., the terms of the export license clearly state that the equipment involved is "not to be used in construction of the proposed Siberian-West European gas pipeline project." The official Department of Commerce announcement also reiterates that "this licensing action in no way diminishes the adminis-

tration's intent to address the long-term security aspects of Western involvement in and dependence on Soviet gas supplies."

The principal players in the negotiations are the major European utilities—Gaz de France, Ente Nazionale Idrocarburi (ENI) of Italy, Mineraloelverwaltung of Austria—led by Ruhrgas of the Federal Republic of Germany. These state-owned or partially state-owned companies have been arranging large gas supply contracts with the U.S.S.R. since the late 1960s. Similar to Urengoi-Yamburg, these arrangements were based on a compensation framework whereby Western equipment was financed through deliveries of gas from the U.S.S.R. Soviet deliveries of gas under these agreements reached 23.5 billion cubic meters in 1980. Urengoi-Yamburg is designed to boost gas deliveries to the above countries by about 30 billion cubic meters a year. In addition, Belgium, the Netherlands, Switzerland, and Sweden would be receiving deliveries of Soviet gas for the first time, so that by 1990 it is estimated that the U.S.S.R. would supply 35 percent of Western Europe's gas requirements.

Western experts calculate that for each dollar spent by the U.S.S.R. on imported technology and equipment, an equivalent ruble expenditure of \$2.00 is required to cover local infrastructure costs, thereby catapulting the total price tag for Urengoi-Yamburg to about \$45 billion. Remarkably, Soviet official claim that earnings from Urengoi-Yamburg gas deliveries will enable them to amortize the \$15 billion Western equipment cost in the short span of two to three years—similar to the accelerated repayment of over \$2 billion in Western loans for the Orenburg gas pipeline.

Needless to say, the packaging of each country's equipment procurement for a project of this size requires elaborate financing arrangements. Thus far the financial side of the negotiations has been the proverbial "fly in the ointment." Financing for Urengoi-Yamburg is being structured bilaterally with each participating country's official export credit program supporting its share of equipment sales.

A consortium of 14 West German banks, led by Deutsche Bank, is orchestrating the major share of the financing. The original terms of the DM 10 billion "in principle" agreement calling for a 10-year loan at a 7.75 percent nominal interest rate became impracticable because of shifts in Bundesbank policy earlier in the year. The ensuing rise in West German domestic interest rates prompted both the banks and Ruhrgas to insist that the wider interest differential be offset by either lower Soviet gas prices or higher West German equipment costs. This complicated loan pricing reflects traditional Soviet insistence of receiving fixed-rate loans at what appear to be lower-than-market rates. These nominal rates are, however, inevitably augmented by more flexible provisions in the commercial contracts.

During the latest round of negotiations with the Soviet Foreign Trade Bank in July a new credit formula was adopted, under which the proposed DM 10 billion credit was trimmed by approximately half the amount. This new financing formula resulted from a decision to split the overall equipment package into two components: gas turbine compressor stations and related equipment, and steel pipe. Although no credit terms have yet been announced, West German commercial bank financing will now be tied solely to the compressors and related equipment. It can be assumed that financing of the steel pipe component will be arranged in the form of supplier credits with all the attendant government guarantees.

A Dutch bank consortium has already concluded a loan agreement with the U.S.S.R. for an eight-year 3 billion guilder (about \$1 billion) credit at a fixed rate of 7.8 percent. The Japanese Eximbank has offered to provide a 10-year \$3 billion credit at a fixed rate of 8.5 percent, but the Soviets still insist on a 7 percent interest rate. However, a compromise agreement is expected to be reached soon. Belgium is also reportedly near agreement on a \$1 billion loan to support the bid of a nine-company supplier consortium.

A group of French banks, led by Credit Lyonnais, initially offered to provide up to FF 15 billion (about \$3 billion) also at 7.75 percent a year. The original French package also called for a FF 1.5 billion untied financial credit. Due to conflicting reports, it is difficult to determine whether the French are delaying in the hope of benefiting from a higher negotiated West German rate, or are genuinely considering scaling down their share of Urengoi-Yamburg gas deliveries.

The economic and commercial rewards for West German participation in resource compensation projects in partnership with the Soviet Union are at least as compelling as those outlined for the U.S.S.R. For example, Urengoi-Yamburg has been under discussion since 1978, when the U.S.S.R. and the Federal Republic of Germany signed a 25-year economic cooperation agreement. Realization of Urengoi-Yamburg would significantly promote the meaningful trade relationship envisioned in this agreement.

Although West German-Soviet trade is still modest compared to West Germany's global trade volume, the U.S.S.R. remains an increasingly attractive export market,

especially given the Federal Republic's need to offset worsening trade deficits with the Organization of Petroleum Exporting Countries (OPEC). In 1980, West Germany's oil import bill came to more than \$20 billion, contributing to a current account deficit of \$14 billion—nearly three times the size of the Federal Republic's first postwar deficit in 1979. Moreover, West Germany's overall economic outlook points to a drop of at least 1 percent in gross national product for 1981, and a projected sharp rise in unemployment from 890,000 in 1980 to 1.5 million in the current year, with the inherent political repercussions.

As West German industry has traditionally represented a major influence on national foreign policy, it can be assumed that Bonn is under intense pressure to seek new or broader political ties with countries that are able to absorb the excess capacity of West German heavy industry. In terms of a break-even analysis of industrial production and profitability, it is clear what the huge equipment orders associated with Urengoi-Yamburg would represent to major industrial suppliers and, conversely, what the loss of such an opportunity would mean in terms of foregone profitability and employment.

For example, the 4-5 million metric tons of steel pipe required for the project would entail annual deliveries of 1 million to 1.5 million metric tons of pipe by West German and Japanese suppliers. To put this figure into perspective the four major Japanese steelmakers have an average annual aggregate production of 2.65 million metric tons of wide-diameter pipe, and the leading West German manufacturer of this kind of pipe has an annual estimated production capacity of about 1 million metric tons.

The accelerated development of Soviet gas resources has established the U.S.S.R. as the largest market for wide-diameter steel pipe in the world. Even while no formal commercial contracts for Urengoi-Yamburg have been announced, a major West German pipe producer earlier this year signed a contract for delivery of 550,000 tons of steel pipe to the Soviet Union. This transaction was described as an ordinary export not associated with any specific project. Japan soon followed suit by extending a \$400 million Eximbank credit to the Soviet Union to finance Japanese deliveries of 750,000 tons of steel pipe between July 1981 and March 1982.

The rewards associated with the Urengoi-Yamburg project for the Europeans are not solely expressed in terms of providing a vital outlet for capital equipment exports, but also in advancing the role of Soviet natural gas in Europe's emerging long-term energy strategy. In general, this strategy aims at a more diversified energy mix with particular emphasis on natural gas. For example, West Germany's energy dilemma is particularly troublesome because of strong domestic resistance to further development of the nuclear energy option, as well as shared European concern over excessive dependency on OPEC.

To illustrate Europe's new emphasis on gas, over the period 1980-1990, gas consumption in Italy is estimated to increase from 25 billion cubic meters to about 45 billion cubic meters; in the Federal Republic of Germany from 60 billion cubic meters to about 80 billion cubic meters; and in France from less than 20 billion cubic meters to a projected 45-50 billion cubic meters.

In order to secure these levels of future gas requirements each country is reassessing its current sources of supply and actively seeking access to new sources. Italy, whose domestic gas production will average roughly one third of overall gas requirements in the 1980s, has secured a new long-term source of supply in Algeria which is designed to contribute an equivalent share. The Soviet Union is intended to supply the remaining third, with additional marginal amounts supplied by Libya.

The current gas supply equation in West Germany breaks down as follows: the Netherlands 37 percent, domestic production 30 percent, the U.S.S.R. 18 percent, and Norway 15 percent. Although the outcome is uncertain, the Netherlands is reportedly resisting extension of its long-term supply agreement due to expire in 1990. Should an agreement be reached concerning post-1990 deliveries, the volume of gas supplies from the Netherlands would probably be at reduced levels. This coincides with an anticipated sharp decline in domestic production by the end of the decade. Urengoi-Yamburg deliveries in projected annual amounts of 12-15 billion cubic meters would significantly offset these shortfalls. A "green light" for Urengoi-Yamburg would mean that the U.S.S.R. would replace the Netherlands as West Germany's major gas supplier by 1990.

The recent decision by the Norwegian government to accelerate exploitation of North Sea oil and gas resources was an unexpected boon in the search for new non-Soviet gas supply sources. Of the overall Norwegian \$5 billion investment allocation for a series of oil and gas projects, the largest and most important is the construction of a 527 mile gas transmission system at a cost of about \$2 billion, that will

transport gas from the Statfjord and Heimdal gas fields to several countries in Europe.

The new gas pipeline system will have a maximum capacity of 15 billion cubic meters, and beginning in 1986 will feed 7 billion cubic meters of gas annually through the existing Norpipe gas system into continental Europe. West Germany will receive 2 billion cubic meters annually. The accepted price for the new Norwegian gas distributed from Emden (West Germany) is \$5.50 per million BTU. Other recipient countries will include France, Belgium, and the Netherlands.

Initially, this incremental 7 billion cubic meters of gas will not significantly change the complexion of the European gas supply situation; however, the planned expansion of the Norwegian gas exports up to 15 billion cubic meters will play a more important role in the next decade. For West Germany, additional Norwegian supplies will help offset the anticipated gas supply shortfalls from the Netherlands and from domestic production. Nevertheless, the Soviet share of total West German gas requirements would still remain at a projected 38 percent in the 1990s.

Bonn officials have repeatedly argued that concern over future West German dependency on Soviet energy supplies is exaggerated. This claim is generally based on the assumption that the share of natural gas in West Germany's overall energy mix will remain in the range of 18 percent, while projected Soviet inputs will account for a modest 5 percent of the country's total primary energy requirements. The basis for this argument is that as Soviet oil supplies to West Germany diminish they will be replaced by increased gas deliveries leaving the level of overall Soviet energy inputs unchanged.

On the surface, this calculation may indeed appear reassuring, but upon closer scrutiny it is difficult to dismiss the significance of Soviet gas inputs to certain industrial regions of the country. For example, Bavaria at present depends on the U.S.S.R. for 80 percent to 90 percent of its total gas consumption. Major Bavarian industrial consumers linked to Soviet gas are the chemical, petrochemical, and automotive industries. The Saar and Rhineland regions rely on Soviet sources for about 50 percent of gas consumption, while for Baden-Wuerttemberg and Hessen the share is somewhat less than 50 percent.

In the event of any interruption of Soviet gas deliveries, the vulnerability of these various regions will depend on the flexibility of West Germany's overall gas distribution system in accommodating the necessary reallocations. However, industry experts have highlighted the difficulty of shifting to alternate energy sources, which would be especially troublesome and costly for industrial sectors such as the petrochemical industry.

Proponents of Urengoi-Yamburg also contend that the U.S.S.R. is a more reliable energy supplier than some Middle Eastern energy exporters. It is true that the Soviets have established a track record for meticulous observance of the terms of commercial undertakings. Nevertheless, disruptions in Soviet gas deliveries to Europe have occurred, most recently this year. The Soviets advised gas distributors in the Federal Republic of Germany and in Austria that first quarter 1981 deliveries were to be cut by one third. In the case of Austria, industrial users were warned to expect cutbacks of up to 50 percent in deliveries beginning in April. Austrian energy experts explained that the disruption in Soviet deliveries was probably due to seasonal difficulties. At the same time, they advanced the theory that sharply reduced deliveries of Iranian and Afghani gas to the Soviet Union may have in turn led to the Soviet gas cutbacks to Western Europe.

A less apparent dimension to East-West resource projects, such as Urengoi-Yamburg, is Moscow's long-term strategy of transforming economic dependencies into tools of international diplomacy. In the words of President Leonid I. Brezhnev: "The accelerated development and exploitation of Siberian natural gas resources is a matter of highest economic and political priority."

Europe's eagerness to reap the benefits of economic and commercial relations with the U.S.S.R. has obscured the risks inherent in striking individual accommodations with Moscow. This narrow approach leading to largely bilateral dealings with the Soviet Union is in no small measure related to the absence of a consistent and clearly enunciated U.S. foreign policy in the past. The physical proximity of the U.S.S.R. and all of its implications justifiably heightens anxiety among Europeans concerning their own security and well-being. A strong and determined U.S. posture would go a long way toward allaying these anxieties and at the same time instilling sufficient confidence for unified action.

The Soviets have predictably used this fragmented European approach not only to extract best possible commercial terms, but also to weaken the political will and resolve of the Western allies. Discernable inroads made by Moscow in this area are reflected in current European attitudes toward important policy issues, such as de-

ployment of the Pershing II and cruise missiles on the Continent, and arms limitation talks.

If reducing European dependency on Middle East oil by moving toward greater reliance on Soviet energy sources represents a real problem, then at minimum it is appropriate to construct a safety net of viable short and long-term alternatives. In the short-term category, Western allies should continue to press for accelerated development of North Sea gas resources. The recent breakthrough in Algerian-Belgian negotiations for a liquified natural gas supply agreement may point the way to similar accommodations with other European gas importing countries. Strategic stockpiling and the establishment of a contingency energy-sharing scheme with the United States and other European energy producers should also be considered as alternatives that could be implemented in the short term.

Perhaps the most secure long-term energy supply alternative lies in the vast underutilized U.S. coal reserves. However, a prerequisite for proper utilization of coal is the accelerated development of the U.S. coal export infrastructure—expansion and improvement of port handling facilities and alleviating transportation bottlenecks. Active participation of major European and Japanese energy importers in the development of U.S. coal export facilities would hasten the process of developing this stable long-term energy flow. The incentive for the United States lies in the favorable impact such arrangements would have on the U.S. balance of payments and domestic employment. These and other alternatives should be developed and implemented on a parallel basis to ensure a meaningful offset to Europe's energy shortfalls, whether or not the Urengoi-Yamburg project goes forward.

How can the Western allies meaningfully respond to the political vulnerabilities inherent in such long-term East-West economic and commercial undertakings?

First, a clear distinction must be made between ordinary commercial relationships and strategic trade arrangements laced with political and security implications. Traditionally there has been substantial confusion in making such distinctions, particularly in the area of high technology transfer and grain sales. Once a decision is made to view an economic or commercial issue as either a lever in furthering foreign policy objectives or a potential political vulnerability, it is imperative to send consistent signals to both allies and adversaries. To do so requires an advance willingness and preparedness to bear the substantial opportunity costs often attendant to such a decision.

As pointed out earlier, the United States appears still undecided as to which category—domestic or foreign policy—the grain issue belongs, with the most recent tendency to view it as domestic economic issue. Similarly the importation of Soviet energy into Europe was consistently viewed as a domestic issue prior to the Urengoi-Yamburg debate. The U.S.S.R. clearly wishes to reinforce these tendencies by pursuing such negotiating tactics as proposing an "embargo-proof" provision in the next long-term grain agreement with the United States. It is conceivable that a similar proposal could be put forward concerning the construction phase of Urengoi-Yamburg that would be designed to safeguard against any possible Western interruption for political reasons.

Regrettably, these undertakings cannot be considered ordinary commercial relationships. A strong argument can be made in favor of the United States keeping its options open concerning grain sales in the interest of tempering Soviet geopolitical behavior. The Europeans, for their part, increasingly have to face the political realities linked to greater dependency on Soviet energy and the U.S.S.R. as an export market for industrial goods.

The flaws of past ad hoc bilateral approaches and the infrequency of summit consultations to address these critical economic and security issues highlight the need for establishing a viable institutional framework through which to handle these issues comprehensively and consistently. Institutions do in fact exist that could be helpful for this purpose.

One possibility is the Directorates for Trade and Commerce and Science and technology of the Organization for Economic Cooperation and Development (OECD). However, the broad membership of OECD would make it difficult to achieve a solid consensus on such sensitive issues. Another alternative would be CoCom (the Coordinating Committee comprising NATO members and Japan), but the technical nature of this body is not particularly suited to this kind of policymaking.

Perhaps the most appropriate framework would be the underutilized Economic Secretariat within NATO. If granted the same status as the organization's military and political secretariats, the principal mandate of this restructured entity would be to candidly review and assess the risks inherent in projects such as Urengoi-Yamburg. Irrespective of the framework selected, the functions that such an organization should perform would include:

Achieving a consensus view on the broader question, namely under what conditions and at what level should the West actively continue to participate in the extraction, processing, and transmission of Soviet energy resources.

Assessing and gauging the disadvantageous economic and political consequences of a specific project for each of the participating countries.

Evaluating and developing various contingency plans and alternatives that would serve to reduce the vulnerabilities associated with any undue dependencies that could result from a project, i.e. the safety net approach.

Establishing and defining parameters of Soviet behavior that could trigger a decision by the West to delay or terminate the project.

Conducting an ongoing assessment of the extent of the West's political leverage through its control of the flow of technology, equipment, and credits as well as Soviet access to major hard currency markets.

Arriving at a meaningful consensus, based on the aforementioned considerations, as to whether or not the inherent risks involved can be sufficiently mitigated to permit the project going forward.

Beyond the benefits of developing a specific institutionalized framework would be the parallel advantages to Western suppliers stemming from the enhanced stability of East-West commercial relations. This is particularly applicable to U.S. companies which in the past have often been hampered by erratic go-no go government decisionmaking.

The Urengoi-Yamburg debate currently revolves around three basic points of view. Most proponents of the project believe that Urengoi-Yamburg should be treated as a routine commercial undertaking on the assumption that East-West dependencies are evenly balanced. This view tends to gloss over the character of the U.S.S.R.'s command economy that is better equipped to implement major shifts in the allocation of resources when deemed politically necessary. The bulk of the resulting hardships have traditionally been absorbed by Soviet consumers who have a far higher tolerance threshold than their Western counterparts.

A concerned group in the administration and in Congress express the view that the project should be interdicted or at least scaled down because of the political and security considerations. In fact, it is now likely that the Europeans will propose a reduction in gas deliveries following newly revised projections of natural gas consumption requirements in the 1980s. Such a proposal would help diffuse opposition to the project, particularly in the United States. However, as projections for gas requirements in the 1990s remain unchanged, any proposed reductions will probably be temporary, with the project reverting to its original scale in the next decade.

Finally, the view expressed herein entails recognition that the project, in some form, will go forward, but urges that a final commitment be contingent on the Western allies proceeding with a safety net of alternatives and the kind of unified policy framework mentioned above. This position can be summed up in terms of putting the horse of a collective Western economic policy towards the U.S.S.R. before the cart of long-term commercial commitments with security dimensions.

After a lull in negotiations, the Soviets are now pressing for a firm commitment to Urengoi-Yamburg prior to President Brezhnev's announced visit to Bonn, currently scheduled for November. If the United States and its NATO partners fail to reach a coordinated policy approach in the near term, they may face the bleak prospect that the project, in turn, will shape the policy.

Mr. GORE. We will hold questions until we have completed the panel.

Mr. Garrett, with Gulf Oil. We welcome you here today. Please proceed.

Mr. GARRETT. Thank you, Mr. Chairman.

Because my comments are a matter of record, I won't read my statement. I would just like to make several observations.

First, about the indigenous Soviet producing capability for crude oil, I think that the ranges that are included in the OTA study certainly embrace the amount of oil that I think will be produced in the Soviet Union.

My personal feeling is that they probably will be able to muddle through at current levels of production for the next 4 or 5 years, and I envision a moderate decline between 1985 and 1990.

I base this observation on several factors. One is the Soviet's own admission that they probably can't do much more than 1-percent per annum growth in petroleum production in their current 5-year plan.

Most governments, as we all know, when they target something, are prone to target as optimistically as they can. Given that proclivity, I would say that the Soviets, at best, will maintain production and probably go into a decline over the next 5 years.

Their situation is not really terribly different from that which we have in the United States. We have to invest tremendous amount of capital just to stand still in our own productive capacity.

Some of that, admittedly, is an inefficient infusion of capital here. I would guess, not having ever been in the Soviet Union or directly witnessing their operations, that their operations are even less efficient than ours.

One other factor to be considered is that in this decade the Soviet withdrawal of their reserves, if they can just maintain current production, will amount to about 45 billion barrels.

On the basis of intelligence data that I have seen, and given the intensity of depletion of the Soviet petroleum industry, I would say that they are apt to be in very bad trouble in the 1990 to year 2000 decade unless they find substantial new reserves either in new fields or they develop the capability to drill and complete at lower depths than they currently can now.

Another factor which leads me to assess the Soviets as essentially being in a static producing situation with reference to crude oil is their target for natural gas exports. The figure that has been mentioned earlier. Sixty billion cubic meters per year, corresponds on a thermal equivalency basis to about 1 million barrels per day of crude oil. That would just about displace what their current or recent petroleum exports to the hard currency area have been.

If we then assume that natural gas will be priced at approximate parity with the petroleum products that they are designed to displace, I would see that as an admission on the part of the Soviets that they need this gas, the gas exports, to maintain their major source of hard currency earnings.

That essentially is all I have, Mr. Chairman.

Mr. GORE. Well, thank you very much for a fine contribution.

[The prepared statements of Mr. Garrett and Mr. Robinson follow:]

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUB-COMMITTEE ON INVESTIGATIONS & OVERSIGHT
UNITED STATES HOUSE OF REPRESENTATIVES

TESTIMONY

MY NAME IS JOHN NORTON GARRETT. I LIVE IN HOUSTON, TEXAS WHERE I AM EMPLOYED AT GULF OIL EXPLORATION AND PRODUCTION COMPANY'S HEADQUARTERS AND PRESENTLY HOLD THE POSITION OF MANAGER OF THE BUSINESS RESEARCH GROUP; I ALSO AM CHAIRMAN OF THE CORPORATION'S CRUDE OIL ECONOMICS COMMITTEE. I HAVE BEEN EMPLOYED BY THE GULF OIL CORPORATION FOR THIRTY YEARS; EIGHTEEN OF WHICH WERE SPENT OUTSIDE OF THE UNITED STATES.

BY PROFESSION I AM A PETROLEUM GEOLOGIST AND AN ENERGY ECONOMIST. DURING EIGHTEEN YEARS IN VENEZUELA, I WAS DIRECTLY INVOLVED IN THE PRACTICE OF PETROLEUM GEOLOGY IN EXPLORATION, FIELD DEVELOPMENT, AND OIL PROPERTY EVALUATION. AFTER LEAVING VENEZUELA IN 1969, I WAS APPOINTED MANAGER OF PRODUCTION ECONOMICS AT GULF'S CORPORATE HEADQUARTERS IN PITTSBURGH, PENNSYLVANIA. I ASSUMED MY PRESENT POSITION IN HOUSTON IN 1976.

I HAVE PARTICIPATED FREQUENTLY IN UNITED STATES GOVERNMENT ACTIVITIES AND PRESENTLY AM A MEMBER OF THE NATIONAL SECURITY COUNCIL'S ADVISORY COMMITTEE ON THE LAW OF THE SEA, THE

DEPARTMENT OF STATE'S OFFICE OF OCEANS AND POLAR AFFAIRS ADVISORY COMMITTEE ON ANTARCTICA AND THE NATIONAL PETROLEUM COUNCIL'S COORDINATING SUB-COMMITTEE OF THE COMMITTEE ON ARCTIC OIL AND GAS RESOURCES. DURING PROJECT PREPARATION, I WAS A MEMBER OF THE CONGRESSIONAL OFFICE OF TECHNOLOGY ASSESSMENT'S ADVISORY PANEL ON TECHNOLOGY AND SOVIET ENERGY AVAILABILITY. ADDITIONAL BIOGRAPHICAL DATA ARE ATTACHED TO THIS STATEMENT.

I BELIEVE THAT THE RECENTLY PUBLISHED OTA DOCUMENT "TECHNOLOGY & SOVIET ENERGY AVAILABILITY" IS A CONCISE AND COMPREHENSIVE ASSESSMENT OF THE CURRENT AND INTERMEDIATE TERM STATUS OF SOVIET ENERGY. IN THIS REGARD, THE STUDY PROVIDES MUCH OF THE BASIC ANALYTICAL DATA NEEDED TO GUIDE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY IN DETERMINING "THE APPROPRIATENESS AND ADVISABILITY OF TRADING WESTERN, PARTICULARLY UNITED STATES, TECHNOLOGY TO THE EASTERN BLOC COUNTRIES".

WITH REFERENCE TO THE CONCLUSIONS AND OPINIONS REACHED IN THE SUBJECT OTA STUDY, I ONLY AM QUALIFIED TO COMMENT ON THOSE THAT DEAL WITH THE PRODUCTION OF CRUDE OIL AND NATURAL GAS. IN THIS REGARD, MY COMMENTS ARE:

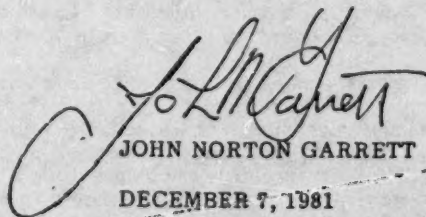
- THE SOVIETS PROBABLY WILL BE ABLE TO MAINTAIN CRUDE OIL PRODUCTION AT ABOUT PRESENT LEVELS OF TWELVE MILLION BARRELS PER DAY THROUGH 1985. DURING THE LATTER HALF

OF THIS DECADE, I ENVISION SOME MODERATE DECLINE IN PRODUCTIVE CAPACITY TO THE EXTENT THAT OUTPUT BY 1990 WILL BE IN THE TEN TO ELEVEN MILLION BARRELS PER DAY RANGE. IN THIS RESPECT, I SEE THE SOVIET SITUATION AS BEING SOMEWHAT ANALOGOUS TO OUR OWN - THAT IS, THE SOVIETS WILL HAVE TO EXERT A TREMENDOUS WORK EFFORT JUST TO MAINTAIN OUTPUT AT PLATEAU LEVELS. ON THE BASES OF WHAT I HAVE READ, AND DISCUSSIONS WITH OTHERS, I SEE VERY LITTLE LIKELIHOOD THAT THE SOVIETS WILL BE ABLE TO SIGNIFICANTLY INCREASE CRUDE OIL PRODUCTION DURING THIS DECADE.

- NATURAL GAS VERY OBVIOUSLY HAS BEEN SELECTED AS THE GROWTH FUEL BY THE SOVIETS. INCREASES IN NATURAL GAS PRODUCTION WILL SERVE NOT ONLY TO PROVIDE SOME OF THE INCREMENTAL ENERGY NEEDED TO SUPPORT SOVIET, AND BLOC COUNTRIES, DOMESTIC ECONOMIC GROWTH, BUT JUST AS IMPORTANT, WILL GRADUALLY DISPLACE PETROLEUM EXPORTS AS THE MAJOR SOURCE OF HARD CURRENCY EARNINGS. UNDERSTANDABLY, THIS ASSUMES THAT THE SOVIETS WILL BE ABLE TO PRICE NATURAL GAS EXPORTS AT APPROXIMATE PARITY WITH THE PETROLEUM PRODUCTS THAT THEY ARE DESIGNED TO DISPLACE.
- OTHER THAN VERY ADVANCED COMPUTER TECHNOLOGY THAT MIGHT HAVE SOME APPLICATION IN THE EXPLORATION EFFORT -

THAT IS, IN SEISMIC RESOLUTION OF COMPLICATED STRUCTURAL RELATIONSHIPS AT DEPTH - I DO NOT BELIEVE THAT THE UNITED STATES NOW HAS EXCLUSIVE CONTROL OVER ANY PETROLEUM OR NATURAL GAS RELATED TECHNOLOGY EVEN THOUGH SUCH TECHNOLOGY MAY HAVE BEEN DEVELOPED BY THE UNITED STATES PETROLEUM INDUSTRY. BECAUSE WE HAVE LICENSED THE MANUFACTURE OF SUCH EQUIPMENT WORLDWIDE, THE SOVIETS NOW CAN PURCHASE IT FROM ANY WILLING SELLER.

ON THE BASIS OF THE FOREGOING OBSERVATIONS OF THE SOVIETS' PETROLEUM AND NATURAL GAS INDUSTRIES - AND THE INTERNATIONAL ACCESSABILITY OF THE TECHNICAL EXPERTISE AND EQUIPMENT NECESSARY TO SUPPORT DEVELOPMENT WITHIN THESE INDUSTRIES - THERE IS VERY LITTLE, IF ANY, INFLUENCE THAT THE UNITED STATES, ACTING BY ITSELF, CAN EXERT, ON FUTURE SOVIET HYDROCARBON (I.E. OIL AND GAS) DEVELOPMENT. ACCORDINGLY, IF THE UNITED STATES DEEMS IT IN THE NATIONAL INTEREST TO EXERT ANY INFLUENCE AT ALL ON EITHER SOVIET HYDROCARBON PRODUCTION OR THE LEVEL OF SOVIET HYDROCARBON EXPORTS TO COUNTRIES ALLIED WITH THE UNITED STATES, WE MUST SOLICIT THE COOPERATION OF BOTH OUR NATO AND OUR PACIFIC ALLIES. THIS WILL REQUIRE DEVELOPMENT OF A COMMON POLICY BY MOST OF THE ORGANIZATION FOR ECONOMIC DEVELOPMENT AND COOPERATION (OECD) GROUP COUNTRIES. TO MY WAY OF THINKING, DEVELOPMENT OF SUCH A COORDINATED POLICY WILL REQUIRE THAT WE, THE UNITED STATES, OFFER ATTRACTIVE - AND TANGIBLE - ALTERNATIVES TO TECHNOLOGY SALES TO - AND ENERGY PURCHASES FROM - THE SOVIET UNION.


JOHN NORTON GARRETT
DECEMBER 7, 1981

TESTIMONY OF ROGER W. ROBINSON, JR.

SIBERIAN GAS PIPELINE PROJECT

Mr. Chairman and members of the committee, it is a privilege to appear before you to discuss some of the economic, political and security dimensions of the proposed Siberian natural gas pipeline project. Before doing so, I would like to point out that I am appearing before the committee on my own behalf, and that the views expressed in my testimony and in any subsequent discussions are my own and do not necessarily reflect the views of the Chase Manhattan Corporation or Bank. Furthermore, I would like to limit my participation in these hearings to discussing those issues directly related to the Urengoi-Yamburg project.

Since 1974, my associate Miriam Karr and I have been closely following developments in East-West trade, particularly those linked to resource development projects in the Soviet Union. The Urengoi-Yamburg project represents a watershed event in this series of major resource compensation transactions and, because of its massive proportion, has given rise to legitimate concern regarding the economic and political consequences of undue dependency of Soviet gas.

This concern prompted us earlier in the year to analyze the compelling commercial and economic underpinnings of the project. Moreover, we felt it important to contribute an American view to the debate over the pipeline and on April 19 published an article in the New York Times entitled "Europe's Big Gamble on Soviet Gas". As events unfolded, we thought it appropriate to expand our analysis to include a Western security and policy perspective. We completed our expanded analysis of the project prior to the July Ottawa Summit and it was subsequently printed in the Congressional Record on October 7, at the time Senator Garn introduced Senate Concurrent Resolution 41. The article, which presently appears in the Autumn edition of the Washington Quarterly under the heading "Soviet Gas: Risk or Reward?" is attached to my prepared remarks.

Our principal objective has been to describe the major technical components of the project and to bring to light some of the important unresolved issues. At the 26th Communist Party Congress in February 1981, President Leonid Brezhnev reiterated that the opening up of West Siberian gas resources and their transmission to the European border of the USSR is the centerpiece of Moscow's energy program extending up to 1990. In President Brezhnev's words "The accelerated development and exploitation of Siberian natural gas resources is a matter of highest economic and political priority." It is Mr. Brezhnev's "political priority" which concerns us and today I would like to outline briefly some of the broader security and policy questions that we identified in the article:

First, the United States and Western Europe have yet to achieve a consensus view on the broader policy question. Namely under what conditions and at what level should the West actively continue to participate in the extraction, processing, and transmission of Soviet energy resources.

Second, there is no clearly drawn distinction between routine commercial transactions and strategic trade arrangements laced with political and security implications. This in turn, poses the related question—Do the substantial commercial rewards associated with projects like Urengoi-Yamburg, which alone will generate about \$15 billion in orders for Western suppliers, obscure the inherent risks?

Third, do deliveries from Urengoi-Yamburg, which, for example, will raise the Soviet share of total gas supplies to the principal participant, West Germany to 38 percent by 1990, cross the threshold of a prudent level of dependency of Soviet gas?

Fourth, there is as yet no adequate institutionalized dialogue between the United States and its West European allies regarding development of a safety net of contingency plans and alternatives to Soviet gas. Examples might include the accelerated development of North Sea gas resources. Strategic stock-piling, an energy-sharing plan, and the joint development of U.S. coal reserves all of which would serve to reduce the vulnerabilities associated with any undue dependencies.

Fifth, the U.S. and its Western allies need to define uniform parameters of Soviet behavior that would trigger a decision by the West to delay or terminate such projects.

Sixth, the Western allies need to engage in a continuous and coordinated assessment of their political leverage as might be exercised through the control of the flow of technology, equipment, and credits as well as Soviet access to major hard currency markets.

At this juncture it is unrealistic to expect that Urengoi-Yamburg can be derailed because of the advanced stage of commitments to the project on both sides, which will be formalized during President Brezhnev's visit to Bonn in less than two weeks.

In recognition of this fact, in my view we should now redirect our efforts to addressing the question—what can be realistically salvaged from this unsettling debate over the pipeline? Should the Western allies continue the past practice of ad hoc, fragmented decision making concerning strategic trade issues, or do we come away from this experience firmly resolved to forge a meaningful unified policy that would effectively balance future commercial rewards against the security risks. Establishing a specific institutionalized framework to treat these strategic trade issues, such as an upgraded and restructured NATO Economic Secretariat, would represent an important step in achieving this unified policy.

Perhaps as important would be the parallel advantages to the Western business community stemming from the enhanced stability of East-West commercial relations. This is particularly applicable to U.S. companies which often in the past have been hampered by erratic go/no-go government decision making. There are clear indications that this Administration is fully appreciative of these past shortcomings and the need to redress them.

Finally, let us hope that we as a country have sufficient vision to support the assessment that these strategic economic undertakings do have to be perceived within the context of Western security. Failure to take advantage of the window of opportunity opened by the Urengoi-Yamburg debate risks compromising NATO's ability to formulate coordinated policy responses to major Soviet geopolitical initiatives.

TRANSCRIPT OF QUESTIONS AND ANSWERS ON SIBERIAN GAS PIPELINE PROJECT

Mr. CHAIRMAN (Senator Jake Garn). Mr. Robinson, we have heard estimates ranging from as low as \$15 billion to as high as \$45 billion for the complete pipeline. Do you have any assessment of what you think the total cost will be?

Mr. ROBINSON. Yes. We looked into that question, and have gone on the following assumption. If you have western equipment and technology import costs for the project that are currently estimated at about \$15 billion, most experts I believe concur, that an equivalent ruble infrastructure expenditure of \$2.00 is required to accommodate each \$1.00 of imported equipment and technology. So if you accept the view that western pipeline orders are in the range of \$15 billion, then I think we can safely assume that the total price tag for the Soviet Union would be catapulted to approximately \$45 billion.

Mr. CHAIRMAN. So you're at the high end, including everything.

Mr. ROBINSON. As a total cost to the Soviets, yes.

Mr. CHAIRMAN. Let me go back to what I was talking to Dr. Kramish about. Why, specifically referring to financing terms now, what keeps the Europeans from charging a premium? Current high interest rates around the world? Maybe the leverage is diminished, but still, purely from a financing standpoint, why in the world are we talking about 7½ percent?

Mr. ROBINSON. Well, it is an acknowledged fact that the equipment orders from each of the participating west European countries are supported virtually in full by their respective government export support programs similar to our ExIm Bank.

Mr. CHAIRMAN. I wish our ExIm Bank were similar in competition to theirs.

Mr. ROBINSON. Yes, we're higher. The Soviets traditionally insist upon what appear to be lower than market interest rates for loans which they attract. These interest costs are traditionally augmented in the provisions of the commercial contracts, i.e. the extra financing costs that may be involved are usually built into the price of the Western equipment. When the financing arrangements were put together, the Western banks offered fixed rate financing for the supplier credits involved in the transaction. The interest rate volatility or the spread between market rates and the fixed rates offered the suppliers is probably partially absorbed under the structure of government guarantees on the bank loans or in the form of some side agreement between the governments and the banks.

Mr. CHAIRMAN. Let's take the negative case and assume the horse is not out of the barn, and we can stop it. So, if the pipeline deal did not go through, what impact do you think that would have on the current Soviet five-year plan and on their hard currency earnings?

Mr. ROBINSON. Well, there's no doubt about the fact that the project will make a very substantial contribution to Soviet hard currency earnings that would help them to meet their import requirements of western equipment and technology needed for the completion of priority economic development projects envisioned in the 15-year development plan that is currently underway. Based on current prices, by 1985 when this project is scheduled to come on stream, Soviet earnings from gas deliveries to the west in total are conservatively estimated to reach a level of about

\$15 billion, of which the Urengoy-Yamburg component is projected to be about \$6-8 billion. Now, these gas revenues, in the second half of the 1980s assume even greater significance at a time when income from oil exports is expected to level off or even decline.

to put these figures into perspective, in 1980, Soviet deliveries of oil and gas to noncommunist countries accounted for at least 60 percent of their total hard currency export earnings of close to \$24 billion. Over and above similar hard currency export earnings projected for this year of about \$25 billion, the Soviets are expected to earn between \$5 and \$5.5 billion from gold and arms sales and \$1 billion on their net invisibles account.

On the expenditures side, the Soviets will have to finance a \$3.5 to \$4 billion estimated hard currency deficit and debt service requirements of another \$3.5 billion, yielding a net earnings position in hard currency for this year in excess of \$20 billion. So in summary, were the USSR denied earnings from Urengoy-Yamburg, it would mean a loss of \$6 to perhaps even \$8 billion per year in the second part of the 1980's and thereby restrict their ability to finance scheduled western imports needed to complete priority development projects. This loss of hard currency revenue, in my view, would also add considerably to the already existing and unexpected cost burdens represented by three consecutive bad grain harvests requiring massive grain imports of as much as 40 million metric tons, at a cost in excess of \$5 billion. In addition, you have Afghanistan-connected expenditures and on-going aid to Poland. Therefore, this foregone income would represent a material blow to the Soviet hard currency earnings account.

[From the Congressional Record, Oct. 7, 1981]

STATEMENT BY SENATOR JAKE GARN

Mr. President, I am introducing for the consideration of my colleagues and the American people a resolution with respect to the proposed Siberian natural gas pipeline project. On June 24, I was joined by over 40 of my colleagues in the House and Senate in writing to President Reagan urging him to review this proposed Soviet energy project, particularly in light of its potentially dangerous implications for the security and cohesion of the Western Europe and the NATO alliance.

My concerns for this project remain strong. I was pleased to see the President adopt a tough stance with our allies at the submit in Ottawa on the issue of the Siberian natural gas pipeline project. At that time, the President urged our allies to reconsider the security implications of this project and to work with the United States in developing energy alternatives which did not carry with them the heavy price of increased dependency on Soviet energy resources. The Department of Energy (DOE) was given the task of formulating these alternative approaches. DOE has, in large part, completed its work, and senior officials from the executive agencies involved will soon be reviewing the DOE analysis. This is a move in the right direction.

On the other hand, however, recent news reports indicat  that U.S. oil companies are deeply involved in the financing negotiations with the Soviets concerning the pipeline. Although I do not question the legality of their involvement at this time, I do not like to see U.S. companies aiding in the bankrolling of a venture which could make Europe more dependent on Soviet energy sources and undermine the long-term security interests of the free world.

I do intend to hold hearings in the Banking Committee to review this entire issue of U.S. export policy with the Soviet Union and its allies. I believe it is appropriate and important at this time, however, to introduce this resolution which expresses the sense of the Congress in support of the position the President took at Ottawa on the pipeline issue. The resolution has three principal points.

First, that the United States should not participate in the construction or financing of the Soviet Siberian natural gas pipeline project;

Second, that the United States should enlist the cooperation of the nations of Western Europe in devising alternative energy programs; and

Third, that the United States should establish a policy with respect to the promotion of the development of Soviet energy resources.

Mr. President, in introducing this resolution, I want to note that it constitutes a companion resolution to House Concurrent Resolution 159, which was introduced in the House by Congressmen LeBoutillier and Nelligan. These gentlemen have provided strong leadership on this issue, and I appreciate their efforts in raising this matter in the House.

Finally, I would also ask unanimous consent that two articles, "U.S. Technology Should Not Be Used To Develop Soviet Energy Sources" and "Soviet Gas: Risk or Reward," be printed in the Record following my remarks. I am particularly pleased to introduce this second article by Miriam Karr and Roger Robinson, Jr., both of whom are vice presidents for Chase Manhattan Bank in New York. These two individuals have written a courageous assessment of the pipeline project which will be printed in the fall edition of Georgetown University's Center for Strategic and International Studies Washington Quarterly.

There being no objection, the articles were ordered to be printed in the Record as follows:

[From the New York Times, Apr. 19, 1981]

EUROPE'S BIG GAMBLE ON SOVIET GAS

(By Miriam Karr and Roger W. Robinson, Jr.)

Soviet officials describe it as "the largest project in recorded history." It is the proposed 3,600-mile natural gas transmission system from the Yamburg gas field, in the Yamal Arctic region of West Siberia, to the western border of the Soviet Union. Depending on pipeline pressure, the Yamburg field is intended to supply 40 billion to 70 billion cubic meters of natural gas a year to 10 European countries—West Germany, France, Italy, Austria, Finland, Belgium, the Netherlands, Sweden, Switzerland and Greece.

While Yamburg would be the largest East-West commercial event ever undertaken, the discussions are being held amid heightened tensions in East-West political relations. Proponents of the deal contend that Yamburg will help stabilize East-West relations. This argument is indeed valid, but only within a framework of clearly defined policy objectives among the Western allies, which at present is not in place.

First, the Western nations and the Soviet Union need time to carve out enough common ground on basic issues, such as spheres of interest and mutually acceptable standards of international behavior, before entering into long-term commitments that may fall victim to short-term crises. For example, the live possibility of Soviet intervention in Poland would no doubt force a firm Western response. It is almost certain that the shelving of Yamburg would be a costly feature of that response—hence the gamble.

Second, Western Europe's efforts to mitigate the risk of dependency on the Organization of Petroleum Exporting Countries by crossing the threshold of a new reliance on Soviet gas requires detailed contingency planning between the United States and its European allies.

The economic rationale for Yamburg is compelling for the Soviet Union and its Western partners. However, the more subtle political aspects of this undertaking have thus far not been adequately addressed—specifically, the Soviet Union's options for the use of energy as an instrument of its foreign policy.

Yamburg has been under discussion since 1978, when the Soviet Union and West Germany signed a 25-year economic cooperation agreement intended to expand trade. West Germany is seeking a more diversified energy mix with particular emphasis on natural gas. But the Netherlands, which now provides 37 percent of Germany's gas needs, is resisting extension of its supply agreement, expiring in 1990. At the same time, West Germany's domestic gas production is expected to decline from 30 percent of needs in 1980 to considerably less by 1990.

Yamburg deliveries would mean that the Soviet Union would replace the Netherlands as West Germany's major supplier by 1990. Even if new gas contracts with Nigeria and Algeria materialize, the Soviet Union's share of total West German needs would still be around 38 percent.

The accelerated development of major West Siberian gas resources—Yamburg, Urengoy and Medvezhye fields—is the centerpiece of Moscow's energy program for the 1980's. The new Soviet five-year plan calls for a dramatic rise in gas production to 600 billion to 640 billion cubic meters in 1985 from 435 billion in 1980. During this period Soviet annual oil production is to peak at 620 million to 645 million tons, only marginally more than the 603 million tons in 1980.

To offset the leveling off of hard currency revenues from oil exports, Soviet leadership is actively supporting large-scale "compensation deals," such as Yamburg, which lock in substantial earnings over time and provide the benefits of much-needed infusions of Western equipment and technology.

A consortium of European companies, led by West German concerns, has been negotiating with the Soviet Union for the supply of 56-inch steel pipe, compressors,

pipelayers and other equipment valued at close to \$15 billion. (Japanese companies are also bidding on contracts for pipelayers and steel pipe, valued at \$3 billion, while the level of United States equipment sales to the project is unclear.)

Most Western experts concur that for each dollar spent on imported technology and equipment, an equivalent ruble expenditure of \$2 is required to cover local infrastructure costs—taking the total price tag for Yamburg to about \$45 billion. Soviet officials contend that earnings from Yamburg gas deliveries will enable them to repay the \$15 billion Western equipment cost in two to three years.

The principal players in the negotiations are the major European utilities led by Ruhrgas of West Germany. These companies have been arranging large gas supply contracts with the Soviet Union—also based on swapping pipeline equipment for gas supplies—since the late 1960's.

Soviet gas deliveries to Europe under those agreements reached 23.5 billion cubic meters in 1980. Yamburg is meant to raise this total by 30 billion cubic meters a year, so that by 1990, it is estimated that the Soviet Union would supply 35 percent of Western Europe's natural gas and about 5 percent of its total energy.

Financing for Yamburg is being structured bilaterally with each participating country's official export credit program supporting its share of equipment exports.

West German banks will be providing the major share of financing. The original terms of the 10 billion deutschemark "in principle" agreement, calling for a 10-year loan at a 7.75 percent nominal interest rate, have been jeopardized by recent changes in Bundesbank policy. The ensuing rise in German domestic interest rates prompted both the banks and Ruhrgas to insist that the wider interest differential be offset by either lower Soviet gas prices or higher German equipment costs. (The Russians often insist on lower-than-market interest rates, but tend, in turn, to be more flexible on other commercial terms.)

A group of French banks initially offered to provide up to 15 billion francs, also at 7.75 percent a year. Although hoping to benefit from a higher German negotiated interest rate, the French are reportedly more interested in moving the project forward than in holding out for a higher return. Dutch and Belgian banks have also concluded or are near to concluding financing packages.

The Reagan Administration views the question of political vulnerability attached to European participation in Yamburg with legitimate concern. West German Foreign Minister Hans-Dietrich Genscher attempted to allay this concern during his recent Washington visit by expressing Bonn's willingness to consult with the United States prior to a final commitment to the project. Yamburg will be prominent on the agenda during Chancellor Helmut Schmidt's planned May visit to Washington.

The United States assessment of the political dimensions of projects such as Yamburg may well advance the concept of a joint Western energy strategy. Encouragement of such an approach would promote a more secure framework for the development and utilization of global energy resources.

(From Inside Washington, Aug. 1, 1981)

NATO ALLIANCE AT STAKE—CAN REAGAN DERAIL SOVIET-GERMAN NATURAL GAS DEAL?

The most important topic brought up at the Ottawa summit was not U.S. interest rates, which many money men predict will soon begin to fall if the President sticks to his economic and monetary program, but strategic trade with the Soviet Union. The President and his aides, including Secretary of State Alexander Haig, are said to have strongly counseled the allies to unite behind a far more restrictive technology transfer policy and specifically warned German Chancellor Helmut Schmidt not to go ahead with a deal in which West Germany would become increasingly dependent on the Soviets for energy supplies.

So firm was the U.S. position that the final communique, though a compromise, did incorporate language calling for the allies to take economic actions that "continue to be compatible with our political security objectives."

Moreover, at U.S. insistence, leaders of the seven major nations at Ottawa agreed to another high-level meeting for the purpose of arriving at "a better definition of what things should and should not be sent" to Moscow "in light of Soviet expansionism."

What particularly concerns the Reagan Administration is Chancellor Schmidt's apparent determination to cut a deal with the Soviets on natural gas. This deal, which Schmidt suggests is innocuous, may, according to Soviet experts here, result in the complete neutralization of Western Europe.

Under the terms of this on-again, off-again project, which was initially okayed by President Carter, the West would supply the Soviets with materials and money so they could lay down a 3,600-mile pipeline extending from the rich gas fields of northwestern Siberia's Yamal Peninsula, across Eastern Europe, to the Federal Republic of Germany. At that point, it would be linked to an existing Western European pipeline network for distribution. Once completed, the Soviets would be able to deliver an estimated 40 billion to 70 billion cubic meters of gas per year into Western European markets.

Indeed, so dangerous is this plan considered to be for the West that Sen. Jake Garn (R-Utah), along with Representatives John LeBoutillier (R-N.Y.) and James Nelligan (R-Pa.), addressed a letter to the President on June 5 in which he outlined his deep concerns. With Garn in the forefront, some 43 senators and House members dispatched another letter to Reagan three weeks later asking for an "immediate" halt to any U.S. participation in the pipeline construction.

Furthermore, Garn outlined several ideas—which the President used at the Ottawa summit which would provide Western Europe with alternative sources of energy.

The President's decision to raise the subject at the summit was also bolstered by a recent study put out by two vice presidents of the Chase Manhattan Bank. In their paper, called, "Soviet Gas to the West: Risk or Reward?" Miriam Karr and Roger W. Robinson Jr. underscore the grave dangers in the pipeline deal.

Under the proposed project, they say, the Soviets would be mainlining gas to 10 European countries—Germany, France, Italy, Austria, Finland, Belgium, the Netherlands, Sweden, Switzerland and Greece. The largest variant of the plan envisions deliveries to Britain and Spain as well.

By 1990, according to the authors, "it is estimated that the USSR would supply 35 per cent of Western Europe's gas requirements," thus making most of NATO increasingly reliant on Soviet energy sources.

Whereas today the Soviets supply just about 18 per cent of what West Germany consumes in natural gas, for instance, by 1990, assuming the pipeline is in place, the Soviet share will have more than doubled. (Other studies show that France, which now receives 7 per cent of its natural gas supply from the Soviets, will be relying on Moscow for more than four times the quantity in 1990. Austria, now receiving 55 per cent of its gas supply from the Russians, will be getting 70 per cent at the end of the decade.)

Moreover, note the authors, many areas of Germany are already overwhelmingly dependent on the Soviets, for natural gas. "For example, Bavaria at present depends on the USSR for 80 per cent to 90 per cent of its total gas consumption. Major Bavarian industrial consumers linked to Soviet gas are the chemical, petrochemical and automotive industries.

"The Saar Rhineland regions rely on Soviet sources for about 50 per cent of gas consumption, while for Baden-Wuerttemberg and Hessen the share is somewhat less than 50 per cent. It is estimated that two-thirds of Soviet gas goes to German industrial users with the remaining one-third going to households."

Not only would Western Europe be far more dependent on the Soviets for energy supplies, but the Russians would be earning enormous amounts of foreign currencies. Moreover, they would be in a perfect position to blackmail NATO governments with potential cut-offs in natural gas. While the Soviets are said to have a good track record for observing commercial undertakings, disruptions in Soviet gas deliveries to Europe have occurred as recently as this year.

The authors of the Chase Manhattan study also say: "A less apparent dimension to East-West resource projects . . . is Moscow's long-term strategy of transforming economic dependencies into tools of international diplomacy. In the words of President Leonid I. Brezhnev: . . . The accelerated development and exploitation of Siberian natural gas resources is a matter of highest economic and political [note: emphasis ours] priority."

With his own gut reactions bolstered by the Garn letter and the Chase Manhattan study, the President, say informed sources, went to Ottawa intent on trying to stop Schmidt, from going ahead with the deal. The President was also vigorously supported in his effort by Pentagon chieftain Caspar Weinberger, U.N. Ambassador Jeane Kirkpatrick and CIA chieftain William Casey. Weinberger and Casey, reportedly, pushed for the President to take an exceptionally tough stance with Schmidt, while Secretary of State Alexander Haig and Special Trade Representative William Brock pressed for the "soft" line.

Nevertheless, Reagan brought up the subject at Ottawa, much to Schmidt's discomfort. Whether the President can eventually force Schmidt to back down is

problematical, but a goodly number of strategic trade experts in Washington think it's absolutely essential if NATO is going to survive as an anti-Soviet force.

Mr. GORE. Well, thank you very much for a fine contribution.

Let me ask first, Mrs. Karr, about the newspaper story from the Associated Press.

The last paragraph says, "Under terms of the license"—this is the export license—"and the sales agreement, the pipe layers were not to be used in building the proposed 3,000 mile Siberian-Western European gas pipeline, known as the Yamal Pipeline"—I will insert (sic) after that—"the Commerce Department said at the time."

Do you think that the restrictions in the recent licenses to Caterpillar will be adhered to?

Mrs. KARR. It is not really relevant, Mr. Chairman, whether the export license restrictions will be adhered to or not. In their overall pipeline construction program, the Soviet Union plans to build seven large transmission pipelines, of which the Urengoi-Yamburg is just one. Whether the pipelayers are used on that particular pipeline or on any of the other pipelines is immaterial, really. The Soviets benefit in either case.

Mr. GORE. So this restriction is irrelevant?

Mrs. KARR. In my view, it is irrelevant.

Mr. GORE. In other words, the export of the pipelayers directly makes it easier for the Soviets to complete the west Siberian pipeline?

Mrs. KARR. I don't wish to voice an opinion of whether the granting of the license was right or wrong. But within the context of granting the license, whether the equipment was licensed for one project or another project, is in my view immaterial.

Mr. GORE. Well, I think that is wellstated. In other words, well, you have said it.

Mr. Robinson, you have had an interesting year, have you not, with the East European banking business?

Mr. ROBINSON. Indeed I have.

Mr. GORE. What effect do you think this impending pipeline will have on Soviet hard currency earnings and East European bloc's access to Soviet energy and their ability to pay for it?

Mr. ROBINSON. Well, clearly the Urengoi-Yamburg projected earnings will make a substantial contribution to the Soviet Union's overall hard currency earning capability.

In terms of figures, we estimate that the total merchandise export earnings in hard currency for the Soviet Union will approximate \$25 billion this year.

In addition to that, we project approximate earnings of another \$5.5 billion from arms and gold sales and another billion dollars in invisible transportation, shipping, et cetera. Against that, the Soviet Union is going to have expenditures of perhaps \$3.5 billion to \$4 billion in their hard currency trade deficit, another \$3.5 billion in their debt service requirements, leaving the Soviets with earnings in the area of in excess of \$20 billion, if you will, on macrodebt scale.

However, the Soviets have experienced unexpected cost burdens in the past 2 years. One of them is Afghanistan connected. Another is ongoing aid to Poland, and the third major one is a third con-

secutive for grain harvest which will necessitate the importation of some 40 million tons of grain at a cost in excess of \$5 billion.

If you accept the estimate that the Urengoi-Yamburg earnings when the project comes onstream sometime in 1985 are in the range of \$6 to \$8 billion which is our estimate, then clearly the project's earnings would make a material difference to the Soviet Union.

Mr. GORE. Mr. Garrett, we had a short discussion earlier about the 1977 CIA oil estimates. Did the major oil companies ever subscribe to that 1977 analysis?

Mr. GARRETT. Those with international dealings, I think, in talking to colleagues in other companies, felt that it was probably a bit low. I think most of us agree, and in talking with friends of mine, that the Soviets can maintain about where they are.

We are very interested in this, of course, because of the international influence on prices. Were the Soviets to become net importers to the degree that the 1977 agency report suggested, and given the constraints on production that at that time were being alluded to by Saudi Arabia of 8.5 billion barrels a day, and given our forecasts for the non-Communist world, particularly the industrial countries' needs for petroleum, we were terribly worried. And we saw that where the agency's figures to material lies, a very strong prospect for adventurism on the part of the Soviet Union because they did not have the money to pay for petroleum imports to the extent of 3 to 4 million barrels a day that the agency figure suggested, and our concern was you can't sell too much vodka and flood the market to the tune of 3 or 4 million barrels a day in the market.

We did not know where they were going to get that money. This worried us dreadfully.

Mr. GORE. In your statement you basically express agreement with the OTA that the United States now has exclusive control over no energy-related technology that is vital to the Soviet Union; correct?

Mr. GARRETT. Yes, sir, I think the one area where we do have an edge and that we have exclusive control is in computer technology, very advanced computer technology, a lot of which was developed during the Vietnam war and which now has some industrial applications in the seismic resolution of complicated structural relationships.

I don't think the withholding or the denial of that technology to the Soviets will have any influence on their ability to produce oil at this time or natural gas. They have found their structures.

In other words, their plan for the next 10 years, I would judge, is largely based upon the location of structures that already have been found, and to a large degree have been tested. They are very much in the same shape as we are.

Recently I served on the National Petroleum Council's Committee for Arctic Petroleum Resources in Alaska, and it looks like we have got an awful lot up there on the basis of a resource base estimate. But if those leases were made tomorrow, it would not be until the early 1990's when much additional oil were to come onstream. And the Soviets in that respect are in the same situation as we are.

Mr. GORE. So the computer technology is of less relevance when you are in the development phase, and in any event, the dual use restriction would apply even more to computer technology than with the other technology in question?

Mr. GARRETT. Yes, sir, I would agree with that.

Mr. GORE. Now, you go on to say that the development of a sensible coordinated policy to minimize West European dependence on the Soviet Union and the vulnerability which many believe might accompany such dependence would require that the United States offer attractive and tangible alternatives.

What would such alternatives be, in your view, more OPEC oil or Nigerian LNG?

Mr. GARRETT. I am a bit more selfish than that. I would like to export more of our coal, Mr. Chairman. I think this Nation has the ability to regain its position of being a net exporter of British thermal units. I think that there are markets, but we have got a lot of work to do just in terms of internal transportation, whether we choose to go by rail or slurry pipeline for coal. We have to develop the export capability for the marine transportation of coal.

And it is my understanding—I have spoken with colleagues in Australia. The Australians have a very concerted effort in developing coal export markets to the Japanese and other countries in the Far East. In talking to some of these people in the Australian Government, the planning people, it made me think that, damn it, if they can do it, we can do it, too.

I say I am selfish there, but I think that the Western Europeans and the Japanese would far prefer to rely on us as the supplier of raw materials than they would the Soviets. I think there is little question of that.

Mr. GORE. I take it you do not agree with the conclusion reached in the current issue of Fortune magazine that we are in imminent danger of overdoing the coal export facilities?

Mr. GARRETT. Possibly over the short term. We need economic growth, whether it be in the Communist world or the non-Communist world, it must be accompanied by energy.

Over the long term, I would say if people can move into a cheaper form of energy and substitute it for the most costly fuel, of course, which is petroleum, nations will do that. I possibly, over the next few years, the Fortune article may have some validity. But I think over the long term, and I am looking, I guess, in terms of a generation given the apathy toward nuclear development in many societies and the substitution capability for coal, I am bullish on coal.

Mr. GORE. It appeared to me that the Fortune analysts were counting chickens that had not hatched yet and even eggs that had not been laid yet in coming to the total that they reached.

Mrs. Karr, in the Washington Quarterly article, you and Mr. Robinson point out that the administration may have lost some important leverage in ending the grain embargo. What sort of negotiations should we pursue with the Soviets at the next opportunity?

Mrs. KARR. We also mentioned in the article that the opportunity has not been lost. Soviet energy trade with the West and U.S. grain sales are the two pivotal issues in East-West trade today. If

consistently treated as strategic trade issues, our policy on grain sales can be used to temper Soviet geopolitical behavior.

Mr. GORE. Say that again now.

Mrs. KARR. U.S. grain sales and Soviet energy supplies to the West are the two focal issues of East-West trade.

Mr. GORE. And we seem to have some confusion and incoherence surrounding both?

Mrs. KARR. Yes, sir, and there was definitely some lack of consistency, at least in the past, on how we treated grain trade and industrial technology trade.

Mr. GORE. Now, let me clarify for the record in all fairness and in the spirit of bipartisanship that that confusion did not really begin with the current administration.

Mrs. KARR. No; definitely not.

Mr. GORE. Go ahead.

Mrs. KARR. But the current administration indeed has an opportunity to correct it.

Mr. GORE. Now, let me ask you the question that I addressed to Dr. Gibbons earlier. If the Alaska natural gas pipeline is undertaken, assuming that the Congress votes approval of it today, and further assuming, which may be a big assumption, that the banks agree to finance it, will the world capital markets, equipment markets, steel markets, and so forth, be able to accommodate the simultaneous construction of the west Siberian project and the Alaska natural gas project?

Mrs. KARR. Well, looking at it from the global perspective two such big projects in the energy resource area are competitive, but looking at the commercial side of it where the Urengoi-Yamburg pipeline is being financed on a bilateral basis which involves the respective countries at government export support programs. In other words, there is substantial government involvement, and banks do not provide private capital at their own risks.

I don't want to go into details about the Alaska gas pipeline financing because it has not been set and no one really knows what shape or form it is going to take. But the great distinction here is that it is going to be private undertaking financed largely by private commercial banking resources.

The financing of Urengoi-Yamburg, therefore, does not directly compete with the Alaska pipeline, because the suppliers for Urengoi-Yamburg do not have to go to international capital markets to raise the funds.

Mr. ROBINSON. I would just like to add that in the context of these export support programs there is a small portion of risk that will be assumed by the commercial banks of the respective countries involved. Therefore, it is not wholly government-guaranteed funding.

Mr. GORE. What about the equipment markets and steel markets?

Mrs. KARR. If we look at overall Western capacity to supply equipment and technology for resource development from a global perspective, then two such gigantic undertakings are indeed competitive even when it comes to equipment supply.

Mr. GORE. So they are.

Mrs. KARR. They are.

Mr. ROBINSON. Although, again, as was pointed out earlier, the gage pipe involved in Urengoi-Yamburg is different from that of Alaska, and these are distinctions.

Mr. GORE. As opposed to 48?

Mrs. KARR. Yes, sir. But we still have to look at overall steel tonnage requirements.

Mr. GORE. Well, are we going to strain the ability?

Mrs. KARR. It is not just a question of whether the ability will be strained or not. The principal issue is where should we really locate our equipment and capital resources to achieve the best results as far as Western energy security is concerned. This was our main concern in making this point.

Mr. GORE. Now, the rate that the Soviets will pay in financing is what, 7.5 percent?

Mrs. KARR. It is about 7.8 percent.

Mr. GORE. And what do you expect the rate to be for the Alaska natural gas?

Mrs. KARR. I could not answer that.

Mr. GORE. It is a little higher than 7.8 percent would not you expect?

Mrs. KARR. Well, but don't forget that the cost deference between the 7.8-percent rate and the real market rate has to be made up somewhere.

Mr. ROBINSON. Just to elaborate on that, the Soviet Union traditionally insists on what appear to be below-market rates for the export financing they attract from the West.

Traditionally, the interest differential is factored into the price of the equipment.

Mr. GORE. Now, my banker charges points. Are we talking about something like that? It just tells me I am in over my head in trying to understand this financing arrangement, but I appreciate you all explaining it, and it helps out tremendously.

What do you think about the vulnerability question, Mrs. Karr? It seems to me your statement presumes that there are two major objectives that you would like to see reached: No. 1, a rational development pattern for the energy resources of the world; No. 2, a pattern of development that minimizes the leverage the Soviet Union is able to exert on the political systems of Western Europe and other countries.

To what extent are those two objectives in conflict?

Mrs. KARR. In principle they are not in conflict. However, at present there are two fundamentally different perspectives in the West concerning relations with the U.S.S.R. The European approach tend to use expanded commercial relationships in the hope that they will provide incentives for greater cooperation on the political scene.

Mr. GORE. Yes, sir.

Mrs. KARR. And then there is the approach a country like the United States should have, which must be much broader. It cannot merely take into account commercial benefit of any given transaction, but as the leading partner in NATO, we have to see it within the overall Western security context.

To bridge these different perceptions is the challenge that we are facing today. The best way that we can accomplish this is to first

clarify to ourselves what our own national policy should be toward trade with the U.S.S.R. Once this is defined we can then face our allies with a fait accompli, and expect a reciprocal response to our policy.

However, we are in no position to exert any influence if we ourselves don't know where we are going.

Mr. GORE. Well, that is a very helpful statement. First of all, you agree that those two objectives can come into conflict, but you take it to a more sophisticated level and say that the United States and our West European allies approach that inherent conflict in a different way.

Mrs. KARR. Yes, sir.

Mr. GORE. As the lead partner in NATO and as the nation most sensitive to the problem of political leverage exerted by the Soviet Union, we have taken, in the past, an approach that attempted to unrealistically deny the momentum behind the first objective, that is, to engineer a rational development pattern of the world's energy resources and minimized unrealistically the attractiveness to West Europe of the Soviet gas supplies and, on the other side of the Atlantic, our West European allies have taken perhaps a naive view that defies unrealistically the likelihood that Soviet policymakers will, in fact, try to use the sale of energy supplies in the future to exert political leverage.

But so long as we and our West European allies approach the problem in a completely different way, the Soviet Union is at an advantage because the West does not have a coherent policy to respond to the Soviet Union.

Mrs. KARR. I agree with you.

Mr. GORE. Is that a fair statement?

Mrs. KARR. Yes, sir.

Mr. GORE. It is a little tortured, but fair.

Now, you put it a lot more succinctly on page 5 of your statement when you say that the object lesson of all this "is the vital need for the formulation of a consistent and comprehensive Western policy that would facilitate the orderly development of future strategic economic relations with the U.S.S.R." I could not agree more. How would you contrast that goal with the current state of Western policy?

Mrs. KARR. Right now we really don't have a clearly defined policy. But we should remember, again within the global context, that we definitely cannot ignore Soviet Union, and we cannot ignore the fact that there has to be some interrelationship, particularly in the natural resource field. However, such large undertakings have to be pursued in an orderly fashion, so that both sides benefit without compromising Western security.

Mr. GORE. Yes, Mr. Robinson?

Mr. ROBINSON. Returning to the statement that you made earlier, Mr. Chairman, in the past decisions concerning grain trade and industrial technology have been made on a largely ad hoc basis as they presented themselves. We have been inconsistent in the treatment of these issues—at times focusing on the domestic political implications, and at other times using trade as a foreign policy tool.

I think that once we come up with a clearly defined judgment as to what constitutes routine commercial transactions and strategic trade transactions, we can then enlist the cooperation of our Western allies and hopefully achieve a consensus view along the lines recommended in our article. Looking as the existing Western institutionalize frameworks where such a consensus could be forged, the most logical, in our view, is a restructured economic secretariat within NATO. This body provides a broader policy making capability as opposed to CoCom which is presently responsible for making more technical decisions concerning technology and equipment.

Mr. GORE. Well, there is such a sharp contrast between the President's approach in Ottawa and his approach in Peoria. Our policy was somewhat bizarre in insisting that the West European allies look at the world in an entirely different way than they clearly perceived it.

What do you think, in hindsight, should have been our policy toward the pipeline?

Mrs. KARR. Well, I would like to inject here another aspect of the West European attitude toward East-West relations. A not very much publicized fact has been that in 1978 West Germany concluded a far-reaching economic and commercial agreement with the Soviet Union which is to last for 25 years. It is a very long-term view and I think that we have not addressed the implication of this agreement carefully. What is the significance of it?

To our mind this pipeline and other energy resource development projects are the first steps in an evolving process that is going to expand. For example, the Soviets have been discussing with the Germans' coal liquefaction. They have good technology in this field.

Mr. GORE. Well, we have just eliminated the funds for our own cooperation with the Germans on that technology.

Mrs. KARR. For the Soviets coal liquefaction capability would reduce the complexity of transporting large volumes of combustible low-Btu coal for use as electricity fuel.

Mr. ROBINSON. In addressing the part of your question on how we might have preferred to see the Urengoi-Yamburg project handled, we would have preferred to have a unified Western policy concerning such economic undertakings and detailed contingency plans in place prior to Western Europe committing to the pipeline.

For instance, the development of a safety net of non-Soviet energy alternatives that could be pursued on a parallel basis to the construction of the pipeline would have reduced, in our view, some of the security-related issues.

We sum up this view in our article by recommending that the horse of a collective economic policy toward the Soviet Union should be put before the cart of long-term strategic commercial commitments. I think this encapsulizes our perspective.

Mr. GORE. Quite well.

Do you think that the distinction between commercial and strategic goods could advance the proposition that the problems associated with licensing should be handled on a more rational basis? Is such a distinction helpful or not?

Mrs. KARR. Yes; such a distinction would be helpful. However, first we have to decide what are commercial transactions? Purely

commercial transactions are those that have no impact on any political-security issues, or the day-to-day transactions that can be undertaken without any undue considerations. Now, what constitutes a strategic trade? This is open to interpretation, depending on who you speak to. The point is that the administration itself is still in the process of formulating a more coherent view of such issues.

Mr. GORE. OK. I would like to thank you all. Let me just say in closing that the purpose of an investigations and oversight committee is to uncover problems that hamper the public interest and it is really a two-step process, as I have viewed it in the 5 years I have been in. One is to recognize conflicts between current policy or current practices and a rational path toward the public interest.

Second, the task is to clearly describe the nature of that conflict, and third is to ask policymakers in our Government correct the picture painted or, in the absence of correction, to describe what actions should be taken to remove the conflict.

The decision by the administration not to appear frustrates the third step in that process, but the decision speaks for itself with respect to their inclination to correct the picture painted, and it is my hope that this endeavor will be a constructive one and we look forward to hearing from the administration at a future time and I hope that together we can remove the conflict in current policy and develop a more rational approach.

Thanks to you and to all of the witnesses who have appeared today, and with that the hearing will stand adjourned.

[Whereupon, at 12:30 p.m., the hearing adjourned.]

[Additional material submitted for the record follows:]

*American Association
for the Advancement of Science*

1515 MASSACHUSETTS AVENUE, NW, WASHINGTON, D. C., 20005

Phone: 487-4400 (Area Code 202)

Cable Address: Advancessci, Washington, D. C.

October 1981

Dear Colleague:

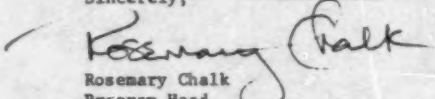
The attached paper has been prepared by Stephen Unger at the request of the AAAS Committee on Scientific Freedom and Responsibility. The Committee believes that the examples of infringements upon scientific freedom discussed in the paper are important ones and merit broader attention within the professional societies and other groups concerned with the work of scientists and engineers. The Committee has recommended that Dr. Unger's paper be circulated to other individuals within and outside AAAS to foster discussion of appropriate means to resolve conflicts between national security interests and scientific freedom concerns. A copy of the CSFR roster is also enclosed.

We welcome any suggestions or comments that you may have on the draft paper. It is to be submitted for publication later in the year.

I also wish to call to your attention an upcoming symposium titled "Striking a Balance: Scientific Freedom and National Security". The symposium will be held from 9:00 AM to Noon on Thursday, January 7, 1982, at the Capital Hilton Hotel in Washington, D.C., as part of the AAAS Annual Meeting.

The symposium is being arranged by Professor Mary Cheh, National Law Center, George Washington University, and includes the following speakers: Peter Denning, President, Association for Computing Machinery; Admiral Bobby Inman, Deputy Director, Central Intelligence Agency; Dan Schwartz, former General Counsel, National Security Agency; Congressman Paul McCloskey (12th district, California), and Harold P. Green from Fried, Frank, Harris, Schriver and Kampelman, Washington, D.C. Further information on the symposium can be provided by my office or by Professor Cheh.

Sincerely,


Rosemary Chalk
Program Head
Committee on Scientific
Freedom and Responsibility

RC/ccsh
Enclosure

NATIONAL SECURITY AND THE FREE FLOW
OF TECHNICAL INFORMATION

Stephen H. Unger
Computer Science Department
Columbia University
September 1981

ABSTRACT

A series of incidents during the past few years has highlighted a trend toward increasing federal controls over the flow of scientific and engineering information. These involve laws and regulations pertaining to the control of exports and to atomic weapons, coupled with invention secrecy laws. In the name of national security, they raise serious questions as to the ultimate consequences to our technological competence and to other important values. These incidents are outlined, along with the aforementioned laws and regulations, and an initial analysis is presented.

Dr. Unger's paper has been reviewed and discussed by the AAAS Committee on Scientific Freedom and Responsibility, which has recommended that the paper be distributed to others within and outside the AAAS in order to foster broader discussion of these concerns. The paper is to be submitted for publication, and is not to be used for quotation without permission from the author.

1. INTRODUCTION

There have always been two principal types of restrictions on the flow of scientific and engineering knowledge:

- (1) information pertinent to military apparatus and methodology has been kept secret by governments.
- (2) information concerning commercially important processes and devices has been kept confidential by private companies and individuals.

In the case of (2), secrecy is often maintained only until patent protection has been assured, although there are important areas where reliance is placed on the trade secret concept rather than on patents, in which case the information may be withheld indefinitely. In the USA, both types of secrecy have generally been confined to fairly specific pieces of knowledge, closely related to particular devices and processes, although there are instances where type (1) secrecy has been much broader. This paper is concerned with certain recent trends in the area of government imposed secrecy.

In the past the government has restricted access to technical information generated internally or by those of its contractors who accepted work with the prior understanding that secrecy was to be maintained. Examples are the precise characteristics of encryption devices used by the diplomatic or military services, the details of detonation systems for nuclear warheads, and designs for surface to air missiles. During time of war the cloak of secrecy has been considerably extended

to include such matters as troop movements and production statistics.

In recent years, efforts have been made to establish government control of a much broader class of knowledge, namely knowledge generated by investigators outside the government, whose projects are not sponsored by agencies related to national security. The concept has been advanced that certain ideas may be declared as secret, regardless of the circumstances of their origin, and that publication thereof may be declared unlawful. This implies the right of the government to impose prior censorship on publications, a notion quite alien to American traditions and law, except for very limited situations in time of actual war.

Another manifestation of the growing governmental concern with security through secrecy is the intermittent effort to make American technology less accessible to foreign nationals. Included in this category are instances where officials demanded that certain people in this category be excluded from several international scientific conferences held in the USA and proposals to isolate foreign students at American universities from certain government sponsored research projects.

After a closer look at some of the situations referred to

above, the motivations for the concern with secrecy will be examined and the implications of the new policies explored. Following this, the legal situation will be briefly outlined.

2. THE CASES

2.1. SECRECY VERSUS PRIVACY

The first category of cases involves the subject of cryptology, which, until recently, was the domain of the military, of intelligence services, of the diplomatic corps, and of puzzle enthusiasts (Ref. 1). Now, however, the advent of large scale digital communications, electronic fund transfer, and the storage of huge amounts of data about individuals and businesses in computer storage banks, as well as a growing concern about privacy in general, has made this into a topic of interest to a far more diverse audience. Important advances in cryptology have been made during the past few years by engineers and scientists outside of the closed group that had previously monopolized it (Ref. 2, 26).

In 1977 the Information Theory Group of the IEEE scheduled a symposium at which important new results in cryptology were to be presented. They established a basis for developing powerful new encryption schemes utilizing fundamental concepts of computer science. Examples of such schemes were included in the papers, which dealt not only with methods for concealing the contents of messages, but also with solutions to the problem of authenticating the authorship of received messages.

Prior to the start of the symposium, a letter was received at IEEE headquarters warning that the presentation of the papers on the program might subject the authors and the IEEE to prosecution under the Arms Export Control Act of 1976. Annotated excerpts from the International Traffic in Arms Regulations (ITAR), issued by the State Department, were enclosed, and the letter was signed by an IEEE member, who gave only his home address. It subsequently emerged that the writer was an employee of the

National Security Agency (NSA), whose functions are to intercept and decipher the communications of foreign governments and to safeguard the secret communications of the U. S. government.

After due deliberation and consultation with their attorneys, the IEEE and the individuals involved went ahead (not without some understandable nervousness) with the symposium, although the papers of some graduate students were presented by their faculty advisors in order to ensure legal backing from their universities. No action was taken by the government (Ref. 3, 4, 5).

It should be noted that Vice Admiral B. R. Inman, then Director of NSA, has denied that NSA has attempted to suppress scholarly work in cryptology and cited with approval a Senate committee finding that Joseph Meyer's letter to the IEEE was a personal initiative (Ref. 28).

In October of 1977, the University of Wisconsin (through an affiliated foundation) filed a patent application for an encryption device invented by George Davida, Associate Professor of Electrical Engineering and Computer Science. Six months later Davida received a letter from the Patent Office informing him that if he disclosed the principles of his invention to anyone other than agents of the U.S. government he would be subject to penalties ranging up to a \$10,000 fine and two years imprisonment. The Secrecy Act of 1951 had been invoked (at the behest of the NSA, it was later revealed). No indication was given as to how long the invention would have to be kept secret, no explanation was offered to justify the secrecy

order and no reference was made to any appeal procedures (Ref. 5, 6).

At about the same time, three engineers, Carl Nicolai, William Raike and David Miller, who had filed for a patent on a low cost voice scrambler that they planned to market through a company they were forming, received a similar secrecy order. A furor resulted as protests were filed and widely reported. The Chancellor of the University of Wisconsin asked for assistance from the National Science Foundation (NSF), the sponsor of Davida's research. In mid June, the order involving Davida was rescinded and the secrecy order on the scrambler was lifted the following October (Ref. 5, 7).

Yet another related sequence of events originated in 1975, when it was suggested to NSF officials, at a low level, that NSA had the sole authority to fund research in cryptography. This was not accepted by NSF, who could find no legal basis to support it. The matter was raised again, more formally, in 1977, at which time NSF agreed to include NSA people among the reviewers of research proposals in the field of cryptography, but did not agree to surrender the right to fund such research at its own discretion. The next step occurred in August, 1980 when Leonard Adleman of MIT and the University of Southern California, a well-known researcher in cryptography, was notified that NSF would not renew his research grant in full because certain parts of his proposal impinged on national security.

Shortly afterward, it was revealed that NSA wanted to fund the research. Adleman recoiled from this suggestion and another storm of controversy ensued. Ultimately, after NSF carried out an internal review of the matter, Adleman received his grant in full (Ref. 5, 8).

In March of 1980, a committee was established to work out procedures for handling national security aspects of open research in cryptography. This committee and its conclusions are discussed in a later section.

The above sketch, though far from comprehensive, illustrates the issues involving secrecy and cryptography. A few brief comments are in order here on the nature of these issues.

Cryptography is an example of an, at least partial, technological solution to a problem that has been intensified by technology. While violations of privacy have existed ever since people have had ears and eyes, the development and widespread use of electronic means for storing, processing and transmitting information, as well as for intercepting such transmissions, has certainly impinged on the privacy of individuals, businesses and other organizations. Modern developments in cryptography promise to provide valuable aids for countering this impact, for example by making telephone conversations less vulnerable to wiretapping. There appears to be a conflict between the need to protect the privacy of the general public, both individually and collectively, and the desires of certain governmental agencies to impose a veil of secrecy over some aspects of technology, and to retain the ability to intercept communications.

A parallel conflict exists between the same governmental interest and the desire of scientists and engineers to pursue their research freely and to develop it for useful purposes. Closely related are rights of free enterprise (well illustrated in the Nicolai case) and First Amendment rights of free speech and press.

On another level, there is a controversy concerning the basic justification underlying governmental interference with cryptology research, namely national security. It is argued (Ref. 5) that allowing open research and publication in this field jeopardizes national security by:

- (1) making available to foreign governments encryption techniques that NSA would have difficulty breaking;
- (2) calling to the attention of foreign governments the vulnerability of their current encryption methods;

- (3) revealing knowledge that might endanger the irrevocability of codes used by the U. S. government.

Although not openly admitted, it is not unreasonable to infer a fourth motivation, namely that point (1) above might also apply domestically, making it more difficult to carry out surveillance of American citizens.

These points have been challenged, for example on the grounds that the knowledge and abilities that produced the new ideas in cryptology are not an American monopoly, and that, with reference to (3), the security of modern encryption systems depends, not on concealing the methodology, but merely on keeping the keys confidential. Rather than focus on these arguments, a counterbalancing argument will be suggested.

Far more than any other major power, the U. S. is heavily dependent, and becoming more so, on electronic communications. In particular, financial transactions are increasingly occurring in digital form. New types of fraud now exist, based on the manipulation of data in computer storage banks, or on the interception and transformation of digitally coded information. As the financial system becomes more enmeshed in this technology, the possibility of large scale disruption leading to economic chaos must be considered. Such disruption would constitute an assault on the national security comparable to the electromagnetic pulse (EMP) problem that has aroused so much concern lately (Ref. 9).

A principal means of defense against both small and large scale "data sabotage" would be the development and widespread deployment in the civilian sector of powerful encryption and verification systems. Thus, there is an important sense in which the national / security would be impaired by inhibiting open research and publication in this field. It should also be noted that this technology is far more important to the United States than to the Soviet Union, which is far behind in the use of digital data processing and transmission.

2.2 BUBBLES AND LASERS

Magnetic bubble devices are computer memory elements with characteristics falling somewhere between magnetic disks, which are low cost, relatively slow, bulk storage systems, and more costly high speed semiconductor memory elements. Only recently has magnetic bubble technology reached the point where it is finding application in commercial equipment. Although they may prove to be useful, not many would consider these elements as being of unusual importance and there seems little reason to consider them as being of great military significance.

In February of 1980, the American Vacuum Society (AVS) held a small (about a hundred participants) international meeting on this topic in Santa Barbara. Five working days before the meeting, the Commerce Department informed AVS that the conference was covered by their regulations concerning exports and that "oral exchanges of information in the U.S. with foreign nationals constitute export of technical data". This would require a license when the destination was Eastern Europe. Failure to comply would expose the conference organizers to large fines and to prison sentences of up to ten years. Written assurances would be required from foreign attendees that such data would not be passed on to Eastern European destinations.

The State Department became involved and, at its suggestion, the AVS rescinded invitations previously extended to Poles, Hungarians and Russians. Commerce and State were in conflict as to whether the three invited Chinese scientists, who had arrived during the controversy, should be excluded from the conference.

Before this dispute could be resolved the meeting began, after the approximately 30 foreign participants signed agreements not to "re-export" what they learned to any of a list of 18 nations (including China). Finally, on the opening day of the meeting, the Commerce Department agreed to allow the Chinese to participate, provided that they signed the agreement (with China deleted from the list), which they did. A government spokesman

explained that the restrictive regulations are not intended to interfere with the exchange of basic scientific information, but only to block the outflow of "information that will enable somebody to build something" (Ref. 10, 11)

Later that same month, another, much larger conference was held in San Diego. Sponsored by the Optical Society of America and the IEEE, it was entitled, the "Conference on Lasers and Electro-Optical Systems and the Topical Meeting on Inertial Confinement Fusion" (CLEO/ICF). In this case, it was the State Department that interfered, notifying the organizers that the eight Russians who had intended to come would be denied visas (this included one member of the CLEOS program subcommittee). In addition, a Russian post-doctoral researcher at the University of Texas, co-author of one of the papers to be presented, was denied permission by the State Department to go to San Diego.

The explanation by the State Department for this action is that a great deal of equipment was exhibited at CLEO/ICF and that disallowing Russian participation was a form of reaction to the Soviet invasion of Afghanistan. No restrictions were placed on the more than 300 attendees from other foreign nations (Ref. 10, 11). It should be noted here that inertial confinement fusion is probably the area of technology in which the U. S. has benefited most from longstanding cooperation with the Soviet Union.

2.3 RESTRICTIONS ON THE CAMPUS

Early in 1981, Cornell University was informed by the State Department that a Hungarian engineer, scheduled to visit Cornell to study electronics, must be limited to classroom study. No private seminars or discussions would be permitted, nor could he receive pre-publication copies of research papers. Under these conditions, the visit was cancelled (Ref. 12).

In April, the State Department notified MIT's Physics Department that it was concerned that a visiting Chinese scholar (participating in an official exchange program) might be exposed to information in a category covered by export control regulations. Questions were asked about the program planned for the visit (Ref. 13).

MIT recently declined a \$250,000 Air Force contract on computer-aided design because it contained a clause restricting the release of results for two years in order to block access by foreign nationals.

The Senate committee report accompanying the authorization bill for the Very High Speed Integrated Circuit (VHSIC) program, which involves both university and industry research, proposed a rather stringent set of restrictions. It implied that ITAR constraints (see Sections 2.1 and 5.1) should apply. (Reference 12, 13). This has been interpreted by the Defense Department to cover only the "applied" part of the research, rather than the "basic" part (Ref. 12). The distinction, admittedly difficult to draw in many cases, is of great consequence, since nationals of other countries would have to be excluded, not only from participation in the applied research, but also from access to information resulting from it. Since

very substantial numbers (probably over a third) of engineering, physics and computer science graduate students at American universities are foreign nationals, it is difficult to see how universities could participate without drastically altering their open character. The problem is compounded by the substantial and growing number of faculty members who are not citizens. Nor is the problem confined to the campus, as industry too has many foreign nationals in its employ, and, for multinational corporations, the difficulties are obvious.

2.4 SECRECY AND THE ATOM

In 1976, L.I. Rudakov, a prominent Soviet physicist, visited the United States and gave several lectures describing his recent work in electron beam fusion, a topic with intended application to controlled thermonuclear fusion for energy production, but also indirectly related to hydrogen bombs. After each lecture, administrators at the facilities where they were delivered were contacted by ERDA officials and told that the subject was classified and that the ideas presented should not be propagated further. Since the reasons for classifying material are themselves considered secret, no explanation has come to light explaining why the American government would want to classify Soviet work that the Soviets themselves are willing to publish (Ref. 14).

A more basic incident occurred in 1979, which involved not the work of a distinguished scientist, but an article written for a political monthly by a journalist. The periodical,

The Progressive

(founded in 1909 by Senator Robert LaFollette, Sr., with a current circulation of about 40,000), was preparing to publish an article by free-lance reporter Howard Morland entitled "The H-Bomb Secret - How We Got It, Why We're Telling It". When a copy of the manuscript came to the attention of the Department of Energy (DOE), that agency declared, early in March, that it contained "restricted data" and asked the editors to revise it. When they refused, a temporary restraining order was sought and obtained from a U.S. District Court in Wisconsin. A few weeks later, following an in camera hearing, a preliminary injunction against publication was issued by the same judge. This was appealed to a Circuit Court of Appeals and hearings were held that September.

The article that provoked this commotion was based on material that Morland assembled from the open literature including declassified government documents. No claim was made by the government that any of this information had been obtained illegally. The basis for the injunction was that the journalist had assembled and presented the information in a manner that would be of material assistance to nations wishing to construct hydrogen bombs. It was the product of Morland's own work, carried out entirely in the non-secret realm, that the government sought to censor. This was the first time in American history that prior restraint was exercised against a publication on national security grounds, with the sole exception of the 1971 Pentagon Papers Case, and in that situation the Supreme Court dissolved the order within a few days.

The Progressive case came to an abrupt end in mid September, prior to completion of the appeal process, when a very similar article, based on the work of another scientifically unqualified person was published by a Madison, Wisconsin newspaper. It was announced by the Justice Department that this event rendered the case moot.

An interesting sidelight on the affair was the manner in which the government utilized its power to classify or declassify information to hamper The Progressive in its legal battle and to manipulate the data released to the press. For example, it was difficult, because of security restrictions, for the magazine to assemble information supporting its contention that the article would not add anything significant to the knowledge of anyone capable of using it, and when it did obtain affidavits supporting its case from experts with access to secret information, their statements were promptly classified. When several Argonne National Laboratory scientists wrote to Senator John Glenn about the misuse of DOE's security classification procedures, their letter was classified. On the other hand, testimony supporting the government case was made public, even though it violated security regulations by commenting on the accuracy of the Morland article.

Subsequently, Livermore Laboratory physicist Hugh DeWitt, one of those who wrote affidavits on behalf of The Progressive, was harassed by DOE and it was alleged that he had violated security procedures. DeWitt fought back strongly with support from a congressman, several scientific societies, including AAAS, and his union. All charges were dropped last autumn (Ref. 5,15).

2.5 A LEGISLATIVE THREAT

This year, a bill was reintroduced (H.R. 109) in the House of Representatives that would add to the Arms Export Control Act a section that would clarify and significantly strengthen controls on the export of information related to items on the Munitions List that is provided for in that law. This list covers a very broad spectrum of technology including cryptology, computers and communications equipment, and technical data relevant to it is also broadly defined.

In order to make it possible to block export of such information, H.R. 109 proscribes publication. Specifically, the operative portion of the bill reads:

Notwithstanding any other provision of law, information specified in such regulations, or materials revealing such information, shall not be published or disclosed unless the Secretary of Defense, in consultation with the Secretary of State and the Secretary of Energy, determines that withholding thereof is contrary to the national interest.

This would place restrictions on the publication of a substantial portion of the work of engineers and scientists in the United States, since prior approval would be required for papers on such topics as lasers, VLSI design technology, computational complexity (which might be related to cryptology), and high energy particle beams. An extraordinary aspect of the

of the wording is that, rather than requiring the government to make a case against publication, the burden of proof is effectively placed on those who wish to publish. And they are required to show, not simply that publication would not be damaging, but that failure to publish would be "contrary to the national interest".

The Council of the Association for Computing Machinery unanimously approved a strongly worded resolution condemning H.R. 109 and the underlying philosophy which produced it (Ref. 16). (This resolution was recently endorsed by the IEEE Computer Society.) It may indeed be the case that such an extreme measure is not likely to be enacted into law, but the mere fact that it could be introduced (in two successive sessions of Congress), coupled with the other incidents related above, cannot be lightly ignored. The motivations involved are outlined in the next section.

3. WHY SECRECY?

3.1 NATIONAL SECURITY

The military strength of the U.S. has, at least during this century, rested on its preeminent status in technology and on the powerful industrial structure that is based on that preeminence. The defense of the country depends, not on a massive standing army, but on the barriers provided by two oceans, buttressed by highly sophisticated weaponry and the capacity to produce quantities of such weapons as needed. The technological superiority referred to here has been a conspicuous element since World War II. The principal military rival of the U.S. and leading candidate as a serious enemy, is the USSR, a nation that has always been

relatively backward in most areas of technology.

In recent years, however, the scientific and engineering supremacy of the U.S. has come into question in a number of important fields. Such nations as Japan and West Germany, for example, have advanced in the micro-electronics area to the point where they have surpassed American firms in certain product lines. Meanwhile the performance of American industry in the area of military hardware has led to increasing doubts regarding its competence. Failures to meet cost estimates and delivery dates as well as operational unreliability have characterized the development of America's latest efforts to develop new tanks, military aircraft and command and control systems. The technical competence of the armed forces themselves has been questioned, particularly in the light of the failure of the attempt to rescue the hostages held in Iran.

These developments have resulted in an uneasiness within certain circles of government about what used to be taken for granted: the continuation of America's technological leadership. Fears have been expressed that we cannot continue to disseminate "know-how" abroad without further eroding that leadership. In particular, it is argued, the Soviet Union, once nearly a decade behind the USA in electronics, has closed the gap to perhaps five years. Why should we help them to close it further by giving away the results of our research and development efforts?

The more sophisticated proponents of secrecy recognize that it cannot be used as a universal and absolute barrier. They propose that it be confined in subject matter to information

that is of immediate use in production processes, thus excluding more basic scientific knowledge from its purview. Furthermore, they do not expect to be able to suppress technological information indefinitely. They indicate that delaying dissemination for a few years would suffice to protect the national security interest in most cases.

3.2 COMMERCIAL INTERESTS

America's technologically based predominance has been challenged in the commercial as well as in the military realm. Not only has American industry been losing its overseas markets (for example in automobiles, machine tools, textiles, audio equipment) but foreign competitors have been displacing U.S. concerns domestically.

Since much of the technology used by foreign companies originated in the U.S., it has been argued that, at least with respect to "leading edge" technology, the transfer of useful industrial knowledge abroad be blocked or at least delayed. The arguments closely parallel those made on national security grounds.

4. THE COUNTERARGUMENTS

While the case for restricting the outflow of technical and scientific information is simple and straightforward, the objections are rather involved and diverse.

4.1 DOES SECRECY REALLY PROMOTE SECURITY?

The first class of objections directly challenges the validity of the argument that the national security would be enhanced by a restrictive policy. This challenge is based on several different considerations. An assumption common to all of them, and one which is almost universally accepted, is that virtually all methods for effectively constraining the flow of information out of the country entail the imposition of restrictions on its domestic circulation. For example there is no practical way of keeping an article published in an American journal from reaching potential enemies or rivals overseas. Hence ideas to be kept from crossing the ocean must also be kept out of general circulation publications, and hence would not be accessible to most Americans.

A direct consequence of this point is that a restrictive information policy would inhibit technological progress within the U.S. by making it necessary to duplicate the work of others and interfering with the interactive process that is so vital to progress in scientific and engineering work. Impeding the exchange of information among American engineers and scientists would probably reduce their output more than the corresponding reduction of knowledge from the USA would reduce the output of their foreign counterparts. This would, of course, undermine the national security by weakening the nation technologically. A bottom line argument here is that the large technological lead enjoyed by the USA was built up and maintained without imposing

significant information barriers. There does not appear to be any increase in the outflow of technical know-how that accounts for the reduction of that lead in recent years.

A second way in which secrecy policies can damage national security is through its direct effects on those who generate the knowledge being protected. Few would deny that being subjected to security regulations is an onerous business. Requirements that prior clearance be obtained before a paper can be presented at a meeting or submitted for publication can only serve to discourage people from choosing to work in a field covered by such regulations. This is particularly true at universities, where researchers, including graduate students, consider publication as important and, furthermore, have a great deal of choice as to what problems to work on. The result of a policy that imposes restrictions on certain areas of technology because they are "vital to the security of the nation" is thus likely to weaken our position in precisely those areas by repelling many bright investigators.

Another set of concerns is related to proposals that would isolate foreign nationals at American universities from research in key areas. It must first be pointed out that perhaps a third of all engineering and science graduate students at leading American universities are not citizens, and that significant numbers of science and engineering department faculties are in the same category, as are growing numbers of engineers and scientists in industry. The contributions made by these people can be gauged in part by simply leafing through the pages

of our scientific and technical journals and noting the backgrounds of the authors. Clearly any field of study that would be closed to foreign nationals would, as a result, be likely to progress at a slower rate. Another consequence would be to reduce the general pool of talented individuals choosing to enroll in science and engineering programs at American universities. This result is hardly likely to strengthen the technological base of America's national security.

A somewhat broader view of national security would also take into account a more indirect effect. The preceding discussion concerned the contributions of those foreign students while resident here. Consider now those who return to their own countries after completing all or part of their educations here. It is reasonable to assume that most of those people will have friendly feelings toward the U.S. and, particularly because some of them will acquire influential positions, will constitute a significant pool of good will that cannot lightly be dismissed from a national security viewpoint.

4.2 SECRECY AS AN ASSAULT ON BASIC VALUES

Certainly one of the leading positive characteristics of American society has always been its openness. The free circulation of information and the lack of constraints on what may be said or printed is taken for granted here. There have of course been times when these traditions have been violated, but they are nevertheless adhered to more strongly in this country than in any other major nation.

A roughly parallel set of ideals has long been associated with the scientific community. The free exchange and open criticism of ideas and data is an integral part of the scientific process. Here too of course there have been departures from the ideal, sometimes on an individual basis and sometimes as a result of the intervention of governments. In particular, generally repressive regimes do not usually hesitate to constrain the flow of ideas in the realm of science as in other areas.

Erecting significant new barriers to scientific communication, and establishing precedents with respect to prior constraints on publication and speech would degrade valuable American traditions and detract from the example of openness that this country has set for the rest of the world. It would also do injury to one of the few existing strands of international cooperation: that which links scientists and engineers across national boundaries.

There is also a conflict between free enterprise and the new forms of secrecy. A clear example of this is the Nicolai voice Scrambler case mentioned in Section 2.1. Broadening constraints on the transmittal of technical information to foreign nationals has obvious negative implications for international trade and for the operations of transnational corporations.

Academic freedom is yet another value jeopardized by the kinds of acts described in Section 2. Universities might be forced to develop all sorts of restrictive procedures aimed at controlling access to seminars and laboratories. Faculty

members would have to be careful to avoid introducing into classroom lectures and discussions certain material developed in their research, and general policies regarding the publication of dissertations would have to be revised.

5. LAWS, REGULATIONS AND RULES

A brief survey of the status of legal and quasi-legal constraints on the flow of information generated in the open sector follows. (Neither here, nor elsewhere in this paper is there a discussion of the system dealing with the security of classified material generated within or by contract with those arms of government concerned with national security.)

5.1 ITAR

The International Traffic in Arms Regulations (ITAR) were originally developed pursuant to the Mutual Security Act of 1954, later largely superseded by the Arms Export Control Act of 1976 (Ref. 5, 17). Administered by the State Department, ITAR is principally concerned with regulating the export of military hardware. The focus here is on its provisions relevant to technical data, as stated in the 1976 version, which is still in effect at this writing. Comments are also made on the proposed revision (December 1980) (Ref. 18).

Technical data is defined in ITAR to include unclassified information useful in "the design, production, manufacture, repair, overhaul, processing, engineering, development, operation, maintenance or reconstruction of...implements of war on the

U.S. Munitions List", or "any technology which advances the state-of-the-art or establishes a new art in any area of significant military applicability". Export of such data in oral, visual or documentary form is subject to control. The U.S. Munitions Control List and the associated definitions is over seven pages long, including all of the obvious items such as automatic weapons, torpedos, and fire control guidance systems. It also includes electronic equipment for spaceflight, aerial cameras, energy conversion devices designed or modified for military equipment, speech scramblers, "privacy devices", computers, telemetering and communications equipment designed for military use.

In conjunction with the broad definition of technical data, it would appear that the regulations would cover, for example, a paper describing an algorithm for designing fault tolerant logic circuits, since this could certainly be applied to the "development" (or "engineering", or "design", or "maintenance") of computers designed for military use. A conference presentation dealing with a technique for improving the detection of signals in the presence of noise would be covered as relevant to design of military radar systems. New developments in metallurgy could easily be considered as applicable to the engineering of military armor plate.

A footnote to Paragraph 125.11 states that:

The burden for obtaining appropriate U.S. Government approval for the publication of technical data falling within the definition in Paragraph 125.01, including such data as

may be developed under other than U.S. Government contract, is on the person or company seeking publication.

Thus, one could reasonably say that a substantial portion of the engineering and scientific community has, for many years, been violating the law and is subject to criminal penalties: up to two years in prison and a \$25,000 fine for each violation.

Defense Department official Larry Sumney was quoted recently as saying, "The ITAR, if enforced to the letter, would cover virtually everything done in the United States. But people understand they are written very generally". He goes on to say that they will not be capriciously enforced (Ref. 19). In fact, no prosecutions have yet occurred for the publication of scientific or technical articles.

A 1978 Justice Department memorandum to presidential Science Advisor Frank Press (signed by Assistant Attorney General John M. Harmon) concluded that "the existing provisions of ITAR are unconstitutional insofar as they establish a prior restraint in disclosure of cryptographic ideas and information developed by scientists and mathematicians in the private sector". It also indicates uncertainty as to the adequacy of the legislative authority for the technical data provisions of ITAR (Ref. 20).

The December 1980 proposed revision of ITAR narrows somewhat the definition of technical data (the part about advancing the state-of-the-art was deleted) and weakens (perhaps effectively eliminates) the requirement to obtain clearance prior to domestic publication. It does not appear however to

ease the restraints on presentations at technical meetings or through other contacts with foreign nationals. With the exception noted, the scope of the information covered is not materially reduced.

5.2 COMMERCE DEPARTMENT REGULATIONS

The Department of Commerce, under the authority of the Export Administration Act of 1979 administers the Export Administration Regulations (EAR), which include a section on technical data (Ref. 5, 21). It was in connection with the EAR that the bubble memory incident mentioned in Section 2.2 occurred. Revisions of the relevant section are now being considered by the Commerce Department.

The EAR definition of technical data is a bit narrower than the ITAR definition in the sense that it applies only to "design, manufacture, utilization or reconstruction", omitting such terms as "engineering, development and maintenance" (see Section 5.1). But, on the other hand, it is broader in that it applies to all "articles and materials", rather than just to weapons related items. However, a general license exempts from control data "generally available to the public in any form", such as items that can be purchased at nominal cost, which are available in libraries open to the public, or which have been orally released at open conferences. The ostensible object of the regulations is to control the outflow of detailed manufacturing information without unduly impeding normal commerce. Those items on the "Commodity Control List" may not be exported to certain categories of nations without first obtaining special export licenses.

A consortium of government agencies, led by the Department

of Defense is completing the assembly of a "Militarily Critical Technologies List" (MCTL), which was mandated under the 1979 Export Administration Act. This program is intended to identify the technological elements essential to an advanced military capability (Ref. 22). THE MCTL will be used to revise the Commodity Control List. It is supposed to exclude the kind of basic scientific knowledge developed at universities. However, there is a considerable grey area between what might be considered as industrial know-how and what is advanced engineering research. This is particularly true in the area of micro-electronics, where there is much overlap between work done at universities and that done in industry (Ref. 19).

5.3 INVENTION SECRECY

Since 1917 there have been laws on the books that permit the government to issue orders requiring that inventions be kept secret on grounds of national security (Ref. 5). Originally this was applicable only in time of actual war. Later legislation removed this restriction, but required that such orders must be reviewed annually in order to remain in force, unless a national emergency has been declared by the president, in which case such orders hold, without the need for renewal, until six months after termination of such emergency. (The emergency declared by President Truman in December 1950, during the Korean War, lasted for 28 years.)

Invention secrecy orders are issued by the Commissioner

of Patents. They block the granting of patents and, under the compulsion of criminal penalties, prohibit the inventor from disclosing the invention to anyone else. Such orders may be issued even if the Patent Office does not, on other grounds, consider the invention patentable, or if the patent application is withdrawn. Inventors may appeal such rulings to the Secretary of Commerce, after petitions to the sponsoring defense agency have been denied. They are entitled to seek compensation for damages, but this right has rarely been successfully exercised. Only 29 claims were filed between 1945 and 1980 (about one per thousand orders): nine of these have been settled, ten denied and the rest are still pending. Litigation is generally quite lengthy: General Electric, in 1977, finally won a suit stemming from a World War II radar invention.

Most secrecy orders pertain to inventions developed by contractors working on military related matters, or by government agencies. These usually concern devices obviously connected with national security, such as missile control apparatus, or processes for making military explosives. But military agencies have also caused the issuance of secrecy orders for inventions such as an antifouling paint used for the hulls of navy ships.

Some secrecy orders have been directed at inventions developed outside of the framework of the government and its contractors engaged in projects related to national security. Two examples, related

to privacy devices, are cited in Section 2.1. Another incident occurred in 1980, when a patent application by Rohm and Haas for an improvement in the technology of electrochemical batteries resulted in a secrecy order being issued at the behest of the U.S. Army. The work involved had been carried out for commercial purposes with company funds. Activity in the area was brought to a halt for about six months until government officials were persuaded to rescind the order. (Reference 23).

In fiscal 1979, about 5% of the over 100,000 patent applications filed were routed by the Patent Office for review by defense agencies. This resulted in 243 secrecy orders,

of which about 40 pertained to work not previously classified. (In addition, about 3300 existing orders were renewed.)

Secrecy orders are issued by the Patent Office when the head of a defense agency issues an opinion that disclosure "would be detrimental to the national security". There is no general procedure for challenging or reviewing such an opinion. No such order has ever been subjected to judicial review for appropriateness nor has there ever been a judicial test on First Amendment grounds

5.4 THE ATOMIC ENERGY ACT

Special secrecy rules apply in the area of atomic energy (Ref. 5). These are administered by the Department of Energy (DOE), successor to the Energy Research and Development Agency (ERDA), in turn the successor of the Atomic Energy Commission (AEC). Authorization for these rules stems from the Atomic Energy Act (latest version passed in 1954) which is intended to protect American security in the nuclear area and to inhibit the international proliferation of nuclear weapons. Another objective of the same law is to promote the development and utilization of atomic energy for peaceful purposes. Clearly there is a delicate balance to be achieved.

Apart from the obvious security rules that apply to weapons related information developed under governmental auspices, there are two dimensions in which the veil of secrecy is expanded. First, with respect to subject matter, there are many areas of knowledge applicable both to weaponry and to non-military

applications. For example, technology concerned with the production of fissionable materials could be applied to support the operation of energy producing nuclear reactors or to facilitate the construction of atomic bombs. The secrecy provisions of the Atomic Energy Act apply to all information considered by DOE to be relevant to national security matters. Of course the growth of the nuclear energy industry both domestically and abroad has greatly enlarged the amount of openly available information.

The second dimension pertains to the source of nuclear related knowledge. Here the law requires that any person making any invention or discovery generally useful in the field of atomic energy is required to file a report with the DOE within six months containing a complete description of it, unless a patent application has been filed. In the latter case, the Patent Office must notify DOE, which may then request a secrecy order (see Section 5.3). In the former case, the DOE may rule that the invention contains restricted data, thus acquiring control over its dissemination. This "born secret" concept, whereby information developed in the open realm, with no access to classified information, may be declared as secret, was the basis for DOE's action with Progressive's case (see Section 2.4). The legal basis for it is rather shaky.

5.5 A PROPOSED SYSTEM FOR VOLUNTARY PRE-CENSORSHIP

An outgrowth of the cryptography controversy (Section 2.1) was the formation, in the Spring of 1980, of the "Public

Cryptography Study Group" (PCSG), assembled under the auspices of the American Council on Education, and funded by NSF. The nine member PCSG consisted of university administrators, nominees of several professional societies and the General Counsel of NSA. There were also a number of authorized observers at its meetings. The goal of the group was to develop a proposal for satisfying NSA's concerns about the publication of research in the field of cryptology without unduly hampering such research or impairing First Amendment rights (Ref. 24).

The PCSG initially considered a proposal, backed by NSA, to institute a system of mandatory constraints that would require all papers dealing with cryptology (as defined by NSA) to be submitted in advance to NSA for prepublication censorship. The burden of proof for restrictions would be on the government, judicial review would be provided (but by a special court acting under "suitable security precautions"), and compensation would be provided for economic losses resulting from imposed constraints. This proposal was rejected, in part because the group felt it had not been able to assess the seriousness of the need for secrecy. The reasons for this inability were that NSA said they could not make their case fully unless the group applied for security clearance, which it did not wish to do, and because the group also did not wish, because of time constraints, to undertake the in-depth study of cryptology which they were told would be necessary to understand the issues.

Another reason given for rejecting the NSA proposal was the negative impact that it might have on cryptology with

consequent harm to individual and commercial privacy as well as to foreign trade. Furthermore, the PCSG found itself unable to frame a definition of what should be kept secret with sufficient precision to satisfy what it regarded as constitutional requirements. Finally the group felt that a compulsory system would not be as practical as a voluntary system which would be more likely to elicit cooperation from researchers in the field.

The result was a recommendation that a system be established, on a trial basis, in which NSA would invite authors to submit to it cryptology related manuscripts for prior review. The definition of the area covered should be determined by NSA, in consultation with appropriate technical societies. It should be as narrow as possible and exclude such fields as "general mathematics, engineering, computer science or statistics, and basic theoretical research". Submitted manuscripts would be promptly returned to the authors with explanations, "to the extent feasible (emphasis added), of proposed changes, deletions, or delays in publication, if any". An author who disagreed with a proposed restriction could request a review by a standing five person Advisory Committee (two appointed by the NSA Director and three by the President's Science Advisor from a list of nominees provided by the President of the National Academy of Sciences) with adequate security clearance (and, presumably, adequately technical background) to hear and evaluate NSA's arguments. It would then make a recommendation to both parties. The entire process would be voluntary, with neither authors

nor publishers being required to participate or to comply with any proposed restrictions.

This proposal was agreed upon by all members of the PCSG except for George Davida (nominee of the IEEE Computer Society) who wrote a minority report (Ref. 24) arguing against any form of restraints. Among his many objections is the difficulty of distinguishing between basic research and knowledge directly applicable to actual systems. As an example, he points out that one of the new encryption schemes depends for its security on the difficulty of factoring very large numbers. This scheme is now incorporated in a system safeguarding a certain nuclear facility. Progress has been made recently toward developing efficient factoring schemes. Should this field of research, one of the oldest in mathematics, now be regarded as falling within the category to be suppressed?

Davida expresses concern that a voluntary system could be a first step toward a compulsory system in that the PCSG report could be used to validate NSA's argument about the necessity for control over cryptology research. He concludes that no useful purpose would be served by such control and that "NSA can perform its mission the old-fashioned way: STAY AHEAD OF THE OTHERS" (emphasis in the original).

Besides Davida, the only other cryptology researcher belonging to the PCSG (as the nominee of the IEEE) was Martin Hellman, Stanford University Electrical Engineering Department. One of the leading figures in the field, he had previously crossed swords with NSA on the issue of the security of the Data Encryp-

tion Standard. Now, however, he supported the PCSG's report and issued a memorandum explaining his stance (Ref. 25). Although sympathizing with Davida's concerns, Hellman states that he feels that NSA has been acting more reasonably since the Spring of 1980 and he wishes to encourage this trend by responding in a positive manner. In addition to supporting the voluntary review procedure, he has himself begun sending prepublication copies of his papers to NSA (without however promising to accede to any requests not to publish). He has also accepted an NSA grant supporting unclassified cryptology research. (On this point it should be noted that Hellman's reputation in cryptology is such that he would have no difficulty in obtaining support from other sources.)

The thrust of Hellman's arguments is that the PCSG's proposal would serve to test the validity of NSA's position by exposing its arguments before the advisory panel. It would be under considerable pressure, he argues, to act reasonably. Finally, Hellman expresses concern that if what he regards as NSA's more reasonable attitude is not rewarded, it will revert to its earlier position. No explanation is provided as to the sense in which NSA has been behaving more reasonably.

Hellman also reports that the Board of Governors of the IEEE Information Theory Group had mixed reactions to the PCGS plan, with several members supporting it fully and a majority having serious concerns about the idea.

6. CONCLUSIONS

Although reasonable people may disagree as to how much governmental secrecy is justifiable, few would deny that there exists at least some information that government should keep confidential.

But there is little evidence to suggest that our government has not been sufficiently secretive. On the contrary, there are all too many indications that secrecy, particularly in the name of national security, has been abused by government officials.

The growing trend, outlined in this paper, toward allowing government to block individuals from revealing or using information that they themselves have generated should be resisted. It is in no sense justifiable, even in the light of a narrow definition of national security. The idea, for example, that federal intervention is necessary to prevent electronics manufacturers from revealing their latest production techniques at technical conferences is patently absurd.

The futility of trying to suppress scientific knowledge in the name of national defense is illustrated by what happened in the early 1940's, when, prior to the initiation of the Manhattan project, American scientists agreed not to publish papers related to nuclear fission, in order to avoid revealing anything that would encourage other nations to try to develop atomic bombs. Observing the cessation of publications by prominent American nuclear physicists, G.N. Pilyorov, a young Soviet physicist deduced that the U.S. must have embarked on

a secret nuclear project and urged his government to proceed without delay in the same direction (Ref. 27).

While the effects on rival nations of a policy of trying to keep American know-how secret are doubtful, the cost in terms of hampering technological progress at home is likely to be high. The free exchange of data and information is a vital part of the process through which engineering and scientific innovation takes place. Injecting bureaucratic clearance and censorship procedures would clearly impede this exchange. To the extent that such procedures focused on any particular field of endeavor, a likely effect would be to discourage people from working in that field. Regulations barring foreign nationals at American universities or industrial firms from access to technical information would deprive this nation of an important source of talent and good will.

Apart from damaging our technological competence, hardly a way to enhance national security, instituting systems of prior censorship, even in one or two specialized fields, would set precedents dangerous to our liberty. Openness, freedom of speech, and freedom of the press are too precious to be jeopardized by what can only be described as a loss of nerve.

Censorship should not be encouraged in any way. Even an apparently innocuous voluntary system as embodied in the PCSG proposal is dangerous in that it establishes machinery and habituates people to accepting its existence. This can significantly facilitate the next step: making it compulsory. The threat of expanding secrecy in technology merits the serious attention of scientists and engineers, both as professionals and as citizens.

References

1. Kahn, David, The Codebreakers, Macmillan, 1967.
2. Diffie and Hellman, "Privacy and Authentication: An Introduction to Cryptography", Proc. IEEE, 7.67, No.3, March, 1979, pp. 397-427.
3. Science, 7/29/77 pp. 438-440; 8/19/77 pp. 747-748; 9/30/78 pp. 1345-1349; 10/7/77 p. 8; 11/4/77 p.476.
4. Unger, S.H., "Privacy, Cryptography and Free Research", Technology and Society (IEEE), Dec. 1977, pp. 8-10.
5. U.S. Congress, House of Representatives Committee on Government Operations, The Government's Classification of Private Ideas. House Report No. 96-1540, December 22, 1980, U.S. Government Printing Office.
6. Kahn, David, "Cryptology Goes Public", Foreign Affairs, v. 58, Fall, 1979.
7. Washington Post, Feb. 17, 1980.
8. Science 8/29/80, p. 995, 10/31/80 p. 511.
9. Broad, W.J., "Nuclear Pulse (I): Awakening to the Chaos Factor", Science, 5/29/81 pp. 1009-1012.
10. Physics Today, April, 1980, pp. 81-83.
11. Science, 3/7/80, pp. 1056, 1058; 5/9/80 p. 577.
12. Science, 5/1/81 pp. 523-526.
13. Physics Today, 6/81, pp. 55-57.
14. Science, 10/8/76 p. 166.
15. Choh, Mary M., "The Progressive Case and the Atomic Energy Act: Waking to the Dangers of Government Information Controls", The George Washington Law Review, v. 48, No. 2, January 1980, pp. 163-210.

16. Denning, Peter J., "ACM President's Letter: H.R. 109",
Communications of the ACM, July 1981, pp. 409-410.
17. "International Traffic in Arms Regulations (ITAR)", Title 22,
Code of Federal Regulations, Parts 121-128, Feb. 1976.
18. Dept. of State, Part XI, "Proposed Revision of ITAR", Dec. 19, 1980.
19. Science, 5/1/80, pp. 523-526.
20. Harmon, John, (Assistant Attorney General, Department of Justice) "Constitution-
ality Under the First Amendment of
/ITAR Restrictions on Public Cryptography", memorandum to Dr.
Frank Press, May 11, 1978.
21. Office of Export Administration, U.S. Dept. of Commerce, "Export
Control of Technical Data, Export Administration Regulations,
Jan. 1979.
22. Lomacky, Oles, "Prepared Statement on the Authorization of Funds
for the Export Administration Act of 1979 for FY82 and FY83",
Background for testimony on behalf of Defense Dept. before
House Committee on Foreign Affairs, Apr. 14, 1981.
23. Personal communication with Warren Niederhauser, Director of Pioneering
Research, Rohm and Haas Company, September 1981.
24. "Report of the Public Cryptography Study Group" (Includes minority report
by Davida), American Council on Education, One Dupont Circle, Washington,
D.C. 20036, Feb. 7, 1981.
25. Hellman, Martin, "Public Cryptography Study Group", Memorandum, Stanford Un.
Dept. of Electrical Engineering, March 11, 1981.
26. Walline, Parker, Wood, "Impacts of Federal Policy Options for Nonmilitary
Cryptography", Research Report 32, SRI, April 1981.
27. Holloway, "Entering the Nuclear Arms Race: The Soviet Decision to Build
the Atomic Bomb, 1939-45", Working Paper No. 9, International Security
Studies Program, The Woodrow Wilson International Center for Scholars,
Washington, D.C., 1979.
28. Shapley, Deborah, "Intelligence Agency Chief Seeks 'Dialogue' with Academics",
Science, 10/24/78, p. 407.

AMERICAN TECHNOLOGY TRANSFER AND SOVIET ENERGY PLANNING

TUESDAY, FEBRUARY 9, 1982

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Washington, D.C.

The subcommittee met, pursuant to call, at 10:05 a.m., in room 2325, Rayburn House Office Building, Hon. Albert Gore, Jr. (chairman of the subcommittee) presiding.

Mr. GORE. The subcommittee will come to order.

The debate concerning the advisability of U.S. trade with the Soviet Union and other Eastern bloc countries has been a lengthy one.

The Committee on Science and Technology has contributed its fair share of words to this debate, and I am sure the issues are well known to us all.

Concern about technology transfer brings up old but important dilemmas of trade boycotts and the possible security risks associated with dual use technologies.

Because the theories surrounding East-West trade had been previously laid out in such detail, it seemed to me a logical step that someone should compile the facts upon which the United States could base its various legislative and policy decisions about technology trade. Many had already asked the question of how trade policy should impact the Soviets.

This subcommittee approached the Office of Technology Assessment with the question: Can we have a significant impact on the Soviet Union's plans in the area of energy production?

I believe the resulting report represented a great step forward in that necessary compilation of hard empirical data.

Concerning the U.S.S.R.'s oil and gas future, this report takes the sensible position that projecting Soviet production is difficult due to the lack of precise information. But the report also includes the revelation that the most crucial sector of Soviet energy expansion will be not oil, but gas.

In terms of special United States technology leverage, it is not a new story that the Soviets could use our drilling and computer capabilities to pursue their goals.

It is news, however, that our technology will apparently have only a limited impact on their plans. For instance, the key deficiency in the Soviets' ability to build the West Siberian pipeline is large-gaged pipe.

(173)

As the study points out, we do not even manufacture this material in the United States. Moreover, the OTA points out that when U.S. equipment is preferred, the Soviets can and do attempt to manufacture it themselves, or do without it.

Perhaps the most crucial finding of the report is that the Soviets seem to be almost always able to find what they need somewhere besides the United States.

So the reality portrayed in this OTA document of limited economic leverage over Soviet energy plans does much to change our operative assumptions about trade policy, particularly when it comes to boycotts and trade linkages.

Given the recent unfortunate events in Poland, one can hardly imagine a more propitious time to be discussing East-West trade policy and the West Siberian pipeline.

The stakes in this issue seem to get bigger with each passing day, until one gets the distinct impression that East-West energy trade is capable of becoming the determining factor in the evolution of our future geopolitical balances.

There is virtual unanimity, at least in this country, about the reprehensible and outrageous nature of the repression in Poland, and the necessity of an effective U.S. response.

We should not be satisfied with the pretense of effective response. Yet many argue that that is what we now have.

There are grounds for debate on what shape a meaningful response should take. That is the reason for calling this hearing.

It is exceedingly important that in contemplating what actions the United States takes in response to Poland, that our actions not be based on false assumptions about the amount of leverage we have over the Soviets.

The OTA's findings surely question the muscle behind the sanctions imposed last December 30.

It is equally important that a U.S. response not have the unfortunate side effects of irreparably damaging the Western alliance or the goals and interests of our Western allies.

Last, and most importantly, it is essential that any policy tack we wind up taking be consistent. And if recent administration courses have been any indication, there is a large margin for improvement.

One cannot help but wonder when an arguably conservative Republican administration is cited for confusion in its foreign policy by such observers as Henry Kissinger and William F. Buckley. But what is perhaps an even more cogent example of inconsistency in the administration's foreign policy is the history of these hearings.

They were originally called for in these hearings on December 10 of last year. Our objective was to discuss the findings of the OTA with representatives from some noted research organizations, financial institutions and the business sector, and then engage the administration in a discussion of those findings. Then something rather extraordinary happened.

On December 9, the day before the last hearing, President Reagan and Senator Percy announced favorable action on the Caterpillar Corp.'s application to export pipelayers to the U.S.S.R. On the same afternoon, the scheduled administration witnesses backed out of the proceeding.

It seems that their anticipated warnings about the inadvisability of assisting Soviet energy development were going to look a bit threadbare in light of the President's announcement.

Ironically, in another reversal, the Caterpillar license was rejected only 3 weeks later as part of the December 30 sanctions.

Confusion should obviously not be the hallmark of any policy, and we surely hope, through proceedings such as this, to help in some way build an informed consensus and realizing full well that the difficulty of this issue confronted previous administrations as well. It is a difficult issue.

The subcommittee appreciates the appearance of these administration witnesses, particularly of Mr. Lionel Olmer. We would like to think that his appearance is a sign that the Commerce Department is taking these problems seriously, and we appreciate your taking the time to appear here today. And we appreciate the other witnesses who have come as well.

Our intent is constructive. We hope that we can contribute to resolution of some of these difficult problems.

[The statement of Mr. Gore follows:]

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

OPENING STATEMENT

HONORABLE ALBERT GORE, JR., CHAIRMAN
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

FEBRUARY 9, 1982

The debate concerning the advisability of U. S. trade with the Soviet Union and other Eastern Bloc countries has been a lengthy one. The Committee on Science and Technology has contributed its fair share of words to this debate, and I am sure the issues are well known to us all. Concern about technology transfer brings up old but important dilemmas of trade boycotts and the possible security risks associated with dual use technologies.

Because the theories surrounding East-West trade had been previously laid out in such detail, it seemed to me a logical step that someone should compile the facts on which the United States could base its various legislative and policy decisions about technology trade. Many had already asked the question of how trade policy should impact the Soviets. This Subcommittee approached the Office of Technology Assessment with the question: Can we have a significant impact on the Soviet Union's plans in the area of energy production?

I believe the resulting report, which you now have, represents a great step forward in that necessary compilation of hard empirical data.

Concerning the USSR's oil and gas future, this report takes the sensible position that projecting Soviet production is difficult due to the lack of precise information. But the report also includes the revelation that the most crucial sector of Soviet energy expansion will be not oil, but gas.

In terms of special U. S. technology leverage, it is not a new story that the Soviets could use our drilling and computer capabilities to pursue their goals. It is news, however, that our technology will have only a limited impact on their plans. For

instance, the key deficiency in the Soviets' ability to build the West Siberian pipeline is large gauged pipe. As the study points out, we do not even manufacture this material in the United States. Moreover, the OTA points out that when U. S. equipment is preferred, the Soviets can and do attempt to manufacture it themselves, or do without it.

Perhaps the most crucial finding of the report is that the Soviets are almost always able to find what they need somewhere besides the United States.

As you can well see, the reality portrayed in this OTA document of limited economic leverage over Soviet energy plans does much to change our operative assumptions about trade policy, particularly when it comes to boycotts and trade linkages.

Given the recent unfortunate events in Poland, one can hardly imagine a more propitious time to be discussing East-West trade policy and the West Siberian pipeline. The stakes in this issue seem to get bigger with each passing day, until one gets the distinct impression that East-West energy trade is capable of becoming the determining factor in the evolution of our future geopolitical balances.

There is virtual unanimity, at least in this country, about the reprehensible nature of the repression in Poland, and the necessity of an effective United States response.

We should not be satisfied with the pretense of effective response. Yet many argue that that is what we now have.

There are grounds for debate on what shape a meaningful response should take. That is the reason for calling this hearing.

It is exceedingly important that in contemplating what actions the United States takes in response to Poland, that our actions not be based on false assumptions about the amount of leverage we have over the Soviets. The OTA's findings surely question the muscle behind the sanctions imposed last December 30th.

It is equally important that a U. S. response not have unfortunate side effects of irreparably damaging the Western alliance or the goals and interests of our Western allies.

Lastly, and most importantly, it is essential that any policy tack we wind up taking be consistent. And if recent Administration courses have been any indication, there is a large margin for improvement. One can't help but wonder when an arguably conservative Republican Administration is cited for confusion in its foreign policy by such observers as Henry Kissinger and William F. Buckley. But what is perhaps an even more cogent example of inconsistency in the Administration's foreign policy is the history of these hearings.

The Subcommittee had originally called for these hearings on December 10th of last year. Our objective was to discuss the findings of the OTA with representatives from some noted research organizations, financial institutions and the business sector, and then engage the Administration in a discussion of those findings. Then something rather extraordinary happened. On December 9th, the day before the last hearing, President Reagan and Senator Percy announced favorable action on the Caterpillar Corporation's application to export pipelayers to the USSR. On the same afternoon, the scheduled Administration witnesses backed out of the proceeding. It seems that their anticipated warnings about the inadvisability of assisting Soviet energy development were going to look a bit threadbare in light of the President's announcement. Ironically, in another reversal, the Caterpillar license was rejected only three weeks later as part of the December 30th sanctions.

Confusion should obviously not be the hallmark of any policy, and we surely hope, through proceedings such as this, to help build an informed consensus.

The Subcommittee appreciates the appearance of these Administration witnesses, particularly of Mr. Lionel Olmer. We would like to think that his appearance is a sign that the Commerce Department is taking these problems seriously, and we appreciate your taking the time to appear here today.

Mr. GORE. I would like to recognize the ranking minority member.

Mr. WALKER. I thank you, Mr. Chairman, and I would like to join you in welcoming Mr. Olmer before the subcommittee today.

Our topic today is of special interest because it combines the question of our proper trade relationships with the Soviet Union and her allies in the Warsaw Pact, and the proper sanctions we should place against a state such as the Soviet Union when it disregards all acceptable standards and violently represses the proper human rights of a vassal state.

Last fall we began these hearings at a time when the primary focus of our hearing was the ability of the United States to actually have any real impact on Soviet policies.

The OTA study, which came out at that time raised some serious and difficult questions as to the very ability of impacting Soviet policies through trade barriers.

However, as often happens in Washington, our initial inquiry was rapidly overtaken by events beyond our ability to control. The Soviets obviously determined that the mere existence of a free labor movement in Poland was a threat to Communist domination of Eastern Europe.

They moved rapidly and ruthlessly through their Polish military puppets to stamp out the last spark of resistance. And they obviously believed that the West was powerless to do anything about it.

Well, we may argue over how effective American sanctions have been, but there is one thing that cannot be disputed. Only 1 year before President Reagan took bold steps to convince the Soviets that their actions in Poland were unacceptable to the United States, his predecessor in the Oval Office had turned off the lights on the national Christmas tree as his primary action against the Soviet invasion of Afghanistan.

As an individual Member of this Congress I believe that the President is deserving of bipartisan support in his efforts to forge an effective policy among the Western allies against the Soviet Union and the Warsaw Pact.

In fact, I am really only concerned at this time that we, as leaders of the Western alliance, may not have gone far enough.

We are now in a time of transition in our dealings abroad with friend and foe alike. The preeminent position of the United States in international affairs has been on the wane for a number of years.

The political turbulence of the Vietnam years did much to erode confidence in American foreign policymakers both at home and abroad.

Where once we were the unquestioned leader of the non-Communist nations of the world, today other nations feel not only justified, but in many cases all but required, to resist American leadership in particular areas.

The other industrialized states of the Western World see the international marketplace as an arena open for exploitation by all countries.

It seems obvious that they often see American attempts to manipulate trade policy as attempts to protect what we see as the American market share.

The nations of Western Europe are far more dependent than we are on imported energy resources. For years they have been held hostage by the OPEC nations and the possibility of another Arab oil embargo is all but enough to bring governments down.

They also see their own enlightened self-interest as being the creation of an economic relationship between Western Europe and the Soviet Union in which the Soviets would become so dependent on the West for hard currencies that they could not cut off that flow of hard currencies by a boycott of Soviet natural gas.

Some of these assumptions may be right, and some may be wrong. The important thing is that the other nations of the alliance led by the United States are no longer willing to accept our leadership in these areas without some reason to believe that it is also in their own best interests.

I trust that today we may have the opportunity to discuss with our witnesses some of these tough questions. What can be done to convince our allies that they should support us in our efforts to bring pressure on the Soviet Union?

What is the best method of accomplishing that objective?

Should sanctions against technology trade be a major weapon in that effort?

Is it an effective weapon?

Are there things that we in the Congress can do to assist the President in this vital area?

Finally, Mr. Chairman, let me say that I, like most of the people in the United States, stand in solidarity with the oppressed people of Poland. For a number of years our Government seemed to wander in the wilderness on the issue of human rights.

In the last administration we seemed to punish our friends for their alleged violations against human rights, only to see them overthrown and replaced by regimes far bloodier and far more repressive.

And as each friend has been abandoned, as each ally has been toppled, the prestige of the United States has also fallen.

This year there is a new President, and a new policy. I am not yet sure that the sanctions announced by President Reagan will convince the Soviets to change their policy toward the free trade union in Poland and Polish internal affairs.

But I am sure that they now realize that there is a new administration in Washington and a new sense of leadership in the Western World. Moscow must now see that it can no longer be business as usual in dealing with the United States.

This President says what he means, and means what he says. And I intend to support him in this effort to convince the Soviets that when this administration stands up for human rights it intends to squeeze until it hurts, because that is the only kind of message that a bully ever understands.

Thank you, Mr. Chairman.

[The opening statement of Mr. Walker follows:]

PREPARED STATEMENT OF REPRESENTATIVE ROBERT S. WALKER

Mr. Chairman, I would like to join you in welcoming Secretary Olmer, before the Committee today. Our topic today is of special interest because it combines the question of our proper trade relationships with the Soviet Union and her allies in the

Warsaw Pact, and the proper sanctions we should place against a state such as the Soviet Union when it disregards all acceptable standards and violently represses the proper human rights of a vassal state.

Last Fall we began these hearings at a time when the primary focus of our hearing was the ability of the United States to actually have any real impact on Soviet policies. The OTA study, which came out at that time raised some serious and difficult questions as to the very ability of impacting Soviet policies through trade barriers.

However, as often happens in Washington, our initial inquiry was rapidly overtaken by events beyond our ability to control. The Soviets obviously determined that the mere existence of a free labor movement in Poland was a threat to Communist domination of Eastern Europe. They moved rapidly and ruthlessly through their Polish military puppets to stamp out the last spark of resistance. And they, obviously, believed that the West was powerless to do anything about it.

Well, we may argue over how effective American sanctions have been, but there is one thing that cannot be disputed. Only one year before President Reagan took bold steps to convince the Soviets that their actions in Poland were unacceptable to the United States his predecessor in the Oval Office had turned off the lights on the National Christmas Tree as his primary action against the Soviet invasion of Afghanistan.

As an individual Member of this Congress I believe that the President is deserving of bipartisan support in his efforts to forge an effective policy among the Western Allies against the Soviet Union and the Warsaw Pact. In fact, I am really only concerned at this time that we, as leaders of the Western Alliance, may not have gone far enough.

We are now in a time of transition in our dealings abroad with friend and foe alike. The preeminent position of the United States in international affairs has been on the wane for a number of years. The political turbulence of the Vietnam years did much to erode confidence in American foreign policy makers both at home and abroad. Where once we were the unquestioned leaders of the non-Communist nations of the world, today other nations feel not only justified, but in many cases all but required, to resist American leadership in particular areas.

The other industrialized states of the western world see the international marketplace as an arena open for exploitation by all countries. It seems obvious that they often see American attempts to manipulate trade policy as attempts to protect what we see as the American market share.

The nations of Western Europe are far more dependent than we are on imported energy resources. For years they have been held hostage by the OPEC nations and the possibility of another Arab oil embargo is all but enough to bring governments down. They also see their own enlightened self interest as being the creation of an economic relationship between Western Europe and the Soviet Union in which the Soviets would become so dependent on the west for hard currencies that they could not cut off that flow of hard currencies by a boycott of Soviet natural gas.

Some of these assumptions may be right, and some may be wrong. The important thing is that the other nations of the alliance led by the United States are no longer willing to accept our leadership in these areas without some reason to believe that it is also in their own best interests.

I trust that today we may have the opportunity to discuss with our witnesses some of these tough questions. What can be done to convince our allies that they should support us in our efforts to bring pressure on the Soviet Union? What is the best method of accomplishing that objective? Should sanctions against technology trade be a major weapon in that effort? Is it an effective weapon? Are there things that we in the Congress can do to assist the President in this vital area?

Finally, Mr. Chairman, let me say that I, like most of the people in the United States, stand in solidarity with the oppressed people of Poland. For a number of years our government seemed to wander in the wilderness on the issue of human rights. In the last administration we seemed to punish our friends for their alleged violations against human rights, only to see them overthrown and replaced by regimes far bloodier and far more repressive. And as each friend has been abandoned, as each ally has been toppled, the prestige of the United States has also fallen.

This year there is a new President, and a new policy. I am not yet sure that the sanctions announced by President Reagan will convince the Soviets to change their policy toward the free trade union in Poland and Polish internal affairs. But I am sure that they now realize that there is a new administration in Washington and a new sense of leadership in the western world. Moscow must now see that it can no longer be business as usual in dealing with the United States. This President says

what he means—and means what he says. And I intend to support him in this effort to convince the Soviets that when this administration stands up for human rights it intends to squeeze until it hurts, because that is the only kind of message that a bully ever understands.

Mr. GORE. Thank you.

Mr. Secretary, we are pleased to have you here. We had earlier invited Mr. Brady and I must say that it is most unusual for someone who is sent out of the country unavoidably to have as his substitute not someone lower down but higher up. And you have convinced the subcommittee by your courtesy and presence this morning of the sincerity of the Department in its grappling with this issue and we certainly appreciate your willingness to come and testify.

Without objection, your entire written statement will be put into the record.

I understand you have an oral version to present and please proceed.

**STATEMENT OF HON. LIONEL H. OLMER, UNDER SECRETARY
FOR INTERNATIONAL TRADE, U.S. DEPARTMENT OF COMMERCE**

Mr. OLMER. Mr. Chairman, my presence here is both a reflection of the esteem in which we hold your committee's work and the importance which we attach to the issue.

I do appreciate the opportunity to appear before you. I think that my prepared statement addresses most of the questions which you had submitted previously to the Department.

In addition, however, I would like to comment specifically on the issues of foreign availability in determining U.S. export licensing policies and; second, on our efforts to secure allied cooperation.

Before beginning, Mr. Chairman, I want to congratulate you and the committee for the OTA study which it sponsored on the subject of technology and Soviet energy availability.

I have read much of it myself and I believe that it adds a wealth of information regarding Soviet energy development and is of great use in the policy debates on this matter of tremendous importance to the United States.

When the President met with our allies at Ottawa some 7 months ago, he stated that we did not believe dependence on Soviet energy supplies to be in Western Europe's national interest. Nor did we want the Soviets to increase their hard currency earnings, earnings which may be used to bolster Eastern bloc indebtedness. And perhaps more importantly, to secure technologies which are only available from the West.

Two-thirds of these hard currency earnings come from Soviet energy exports.

The position enunciated at Ottawa has not changed. However, what has changed since last July is Soviet behavior. In the midst of the policy debate on how best to achieve our objectives, martial law was declared in Poland and the Soviets were held directly accountable.

As a result, the President ordered two actions which affected Soviet oil and gas development: foreign policy controls were extended to transmission and refinement equipment and processing of all licenses was suspended.

As your OTA study indicates, projections of Soviet oil production differ widely, and due to a variety of problems related to their oil production, development of their gas resources is "the key to Soviet's energy future in this decade."

Under the current 5-year plan, the Soviets expect to lay some 20,000 kilometers of large diameter gas trunkline, of which the Siberia-West European pipeline represents only 20 percent. To develop these resources, reliance on Western technology and equipment is vital and it will increase.

As I stated at the outset, I want to underscore two points. The first deals with foreign availability. The Export Administration Act of 1979 requires the Department of Commerce to assess the availability of foreign goods and technology with respect to both quantity and quality.

Although the statute seeks to minimize the extent to which our export controls cause U.S. industry to lose business to their competitors, it did not intend nor does it state that sales of equipment and technology should be permitted to run counter to our national security and foreign policy interests solely due to foreign availability.

In the years following World War II, the United States clearly possessed technological superiority over the entire world and could thus control the availability of equipment or the development of technology.

Now, our technological edge has vanished in many areas or been reduced to a thin lead. The technology is diffused throughout the world through subsidiaries, licensees, and manufacturing associates.

Some claim that because of wide dissemination of U.S. technology over the past several years, particularly in the areas related to oil and gas equipment, there is little we can do to prevent the Soviets from purchasing much of the equipment which is necessary for energy development.

The OTA study states that "with few exceptions, adequate quantities of the energy equipment sought by the Russians are produced and available outside the United States and that the quality of these foreign goods is generally comparable to that of their U.S. counterparts."

I don't quarrel with that. Although large diameter pipe represents about a third of the cost of the pipeline, the United States does not produce it.

What we believe is more important to timely completion of the pipeline is our technological lead in producing compressor stations used to pump the gas through the pipeline and the turbines which run the compressors. Most turbines use components which are products of U.S. companies or U.S. technology and that brings me to my second point.

Although the United States, because of its technological lead in certain aspects of pipeline technology and equipment, has the ability unilaterally to inflict considerable short-term costs on construction of the Siberian-West European pipeline, over the long run effective controls that significantly affect Soviet oil and gas production and distribution will require a multilateral approach.

Through these past weeks, the United States has been working closely with our allies. In a variety of ways and through a variety of means the allies have been made aware of the importance we place on constraining Soviet behavior.

In the furtherance of U.S. policy and in fairness to U.S. firms, we have attempted to prevent foreign companies from filling the breach.

We have obtained commitments from our allies not to undercut our sanctions nor to pick up contracts dropped by U.S. companies in response to these sanctions.

We will continue to stress the importance of our sanctions, and we will continue to seek cooperation from our allies to restrain competitors of U.S. firms.

The U.S. business community has generally been understanding of the President's December 29 action and it is clear that no firms condone Soviet actions.

Although there is some disagreement in the business community as to how effective these new controls can be, the administration strongly believes that we cannot do business as usual under current circumstances.

In addition, our policy enunciated 7 months ago to forestall a growing dependence on Soviet energy exports and to limit the Soviets hard currency earnings remains firm.

Consequently, we are doing everything we can to ensure the effectiveness of the controls. We will continue to explore all possibilities of achieving those objectives, perhaps including most importantly, seeking continued cooperation of our allies.

Mr. Chairman, I would like to remain for the first round of questioning and with your permission, after that would like to substitute on my behalf Deputy Assistant Secretary Denysyk, who is quite familiar with the technology and export licensing in general regarding the Soviet energy developments that you are so interested in.

[The prepared statement of Mr. Olmer follows:]

STATEMENT OF LIONEL H. OLMER
Under Secretary of Commerce
for International Trade

Before the Committee On Science and Technology
U.S. House of Representatives
Washington, D.C.

February 9, 1982

Mr. Chairman,

I appreciate the opportunity to appear before the Committee on Science and Technology to discuss U.S. policy toward future Soviet energy development. I will focus specifically on the issues raised by the Soviet effort to enlist Western cooperation in the construction of a 3,000 mile pipeline to deliver Siberian natural gas to Western Europe. This is the most important Soviet energy project planned for the 1980's. It also represents the largest single East-West commercial transaction in history and, if completed, would dramatically increase the level of economic and political interdependence between the Soviet Union and the free nations of the world.

The Soviet Energy Dilemma

The USSR is, today, the only major industrial power in the world that fully meets its requirements in energy resources and, moreover, exports these resources. Soviet oil and gas production has increased steadily over the past two decades. By way of comparison, Soviet oil production was 42 percent of that of the U.S. in 1960. Today it surpasses U.S. production by 20 percent.

Nonetheless, the Soviet Union may face serious energy problems in the near term. Proven oil reserves have been falling during the 1970's, and a decline in oil production could develop any time after 1985. The primary obstacles to a more rapid expansion in output are bottlenecks in exploration and development of new oil fields located in harsh permafrost regions.

Soviet officials themselves are probably uncertain about the future dependability of oil. The goal for production in 1985 is 12.4-12.9 mb/d, but even this modest increase over 1981 levels (12.2 mb/d) may be difficult to achieve.

Western predictions of Soviet energy production capabilities vary. In December of 1980, the CIA revised its 1977 forecast of precipitous declines (to about 8.5 mb/d) and now estimates that oil production will level off and then decline by the mid-1980's. The Defense Intelligence Agency predicts oil production will remain relatively stable through the 1980's, and possibly rise in the 1990's. Accurate Western forecasting of Soviet oil production capabilities is made nearly impossible by secrecy surrounding the oil reserves/resources data, which the USSR has classified for the past several years.

Given the uncertainty of Soviet oil production and exports, Soviet leaders have decided to accelerate the development of the USSR's huge natural gas reserves. The centerpiece of this effort, of course, will be the 3,000 mile pipeline linking the Urengoi natural gas fields in Siberia to Western Europe.

I would like to emphasize that the Soviet leaders cannot afford a decrease in earnings from oil and gas exports. Reductions in oil exports would have serious consequences for the Soviet economy, which is already overstrained by steadily falling rates of growth and productivity as well as by excessive levels of defense spending. Oil exports now account for nearly two-thirds of the USSR's hard currency earnings used to purchase grain and technology from the West. These imports cannot easily be scaled back. Oil deliveries to Eastern Europe, however, also must be maintained at

present levels. The economies of several of these nations are already in a precarious condition. The USSR will face serious risk in the 1980's if it reduces its substantial energy deliveries to its East European satellites.

The Siberian Natural Gas Pipeline

With vast inputs of Western capital, equipment, technology, and materials such as large-diameter pipe, Soviet leaders intend to launch a mammoth natural gas development program during their current eleventh Five-Year Plan (1981-1985). The overall target is to spur gas production from 435 billion cubic meters (BCM) in 1980 to an impressive 600-640 BCM by 1985. The pipeline to Western Europe is slated to supply at least 36-40 BCM of natural gas per year to six West European countries. By 1990, total deliveries are expected to constitute up to a 30-35 percent share of natural gas requirements for certain European nations.

To achieve this goal, the USSR plans a 100 percent increase in natural gas investments during the plan period, raising total investments in gas to about \$26 billion. Soviet leaders hope to supplement this amount with \$10 to \$15 billion in credits from the West for the purpose of constructing the West Siberia-West Europe

Pipeline, which may eventually consist of two strands. According to the Defense Intelligence Agency, this is not the only gas trunk line envisioned in the Eleventh Five-Year Plan since the volume of material being ordered from the West (pipe and equipment) indicates that at least four new domestic lines may also be constructed.

The Soviet Union entered the 1980's with more than 40 percent of the world's gas reserves. Current explored reserves are estimated at 1 quadrillion cubic feet. The Soviet gas pipeline network has grown very rapidly in the past 15 years, from only 5,000-km in 1965 to nearly 125,000-km by the end of 1980. But for the USSR to accelerate the exploration of its natural gas reserves in time to provide the Warsaw Pact Nations an adequate measure of energy security in the 1980's, the USSR will be forced to turn to the West, including the United States, for assistance.

The enormity and complexity of the West-Siberia-West Europe pipeline present the Soviet leadership with some formidable challenges. The harsh Siberian climate imposes limitations on the types of equipment that can be used to build and maintain the pipeline. In fact, many observers with actual experience in pipeline construction doubt that the project will be completed on schedule or within original cost estimates.

Given the Soviet geographical, climatic, and technological constraints, there remain a few areas the U.S. could unilaterally, or with the cooperation of a few countries, delay the construction

of the pipeline. For instance, the U.S. has a special ability to supply the key components in quantity for the gas turbine engines needed for the pumping stations.

The Commerce Department is still investigating the extent of foreign availability of essential equipment for this project. We agree with the OTA study that the task of devising more effective export controls is made more difficult by the ability of multinational corporations to disseminate technology and production facilities around the world.

The exports of certain oil and gas commodities are controlled for purposes of foreign policy or national security. Foreign policy controls now extend to most equipment exports in the areas of exploration, drilling, distribution and refining operations. National security controls extend to all technology transfers. Dual-use items that have direct military applications, such as computers, are, of course, presently under national security controls. I have attached a chart that illustrates the interplay of the proportions of export controls maintained for each purpose.

(Chart I)

The View from Europe

West European leaders are now considering Soviet proposals for large energy cooperation projects, of which the natural gas pipeline is only the most highly publicized. A few months ago the USSR began negotiations with West Germany to purchase a \$3 billion plant for the conversion of Siberian coal to synthetic gasoline and diesel fuel, a process that was first developed by I.G. Farben before the Second World War. If this project is successful, the Soviet Union may decide to move ahead with several similar proposals in the decades ahead.

The USSR has for many years sought to expand its energy-related trade with the West. Since 1975, European interest in Soviet energy development projects has grown for two principal reasons. First, there is a perception that some governments in the Middle East have become less rather than more stable, and that future oil deliveries could again be interrupted as they were in 1973. Second, in recent years Western Europe, Japan, and the U.S. have significantly increased their exports to the USSR of energy related equipment, and these exports have created tens of thousands of jobs. It is estimated that energy equipment imports will constitute about 20 percent of total Soviet imports from the West in 1981. Over the past five years, Soviet orders of oil and gas equipment have totaled about \$7.4 billion. Chart 2 shows how these sales were divided among major suppliers.

The sales have created significant dependencies by some Western countries on Soviet markets. This dependency translates into intense domestic pressure -- especially during times of recession -- to boost export sales to the USSR. This pressure certainly explains, at least in part, the enthusiasm of certain Western commercial and labor constituencies for the Siberian project.

West Europeans, however, are not only worried about maintaining domestic employment in key industrial sectors; they also believe that the pipeline will improve their energy security through diversification of energy imports and that it will enhance Soviet-European relations.

U.S. Strategic Concerns

Despite these rationales, the Administration remains convinced that it is not in the West's best long-term interests to increase dependence on Soviet energy supplies. The Siberian pipeline opens a new stage in East-West commercial, political, and strategic relationships which deserves a careful review.

Once the pipeline project is initiated, the USSR gains several short-term and long-term advantages, including:

- The Soviet economy would receive a substantial boost from the \$10 billion in Western investment destined for the Siberian project as well as future hard currency earning capacity. Such an infusion of capital could be a real spur for Soviet growth rates which have steadily fallen over the past 15 years. The USSR's annual rate of growth in the GNP was 5.3 percent from 1965 to 1970, 3.8 percent from 1970 to 1975 and 2.8 percent from 1975 to 1980.
- If the USSR succeeds in obtaining maximum output from the Urengoi natural gas fields and in building the export line to Europe, it will have taken an important step towards the goal of developing Siberia. The industrialization of Siberia constitutes one of the major economic development priorities of the Soviet government.

- The Soviet Union would preserve energy self-sufficiency not only for itself but for the Warsaw Pact nations as well. The West as a whole, of course, would continue to be vulnerable to energy supply disruptions whether from OPEC, the USSR, or both simultaneously.

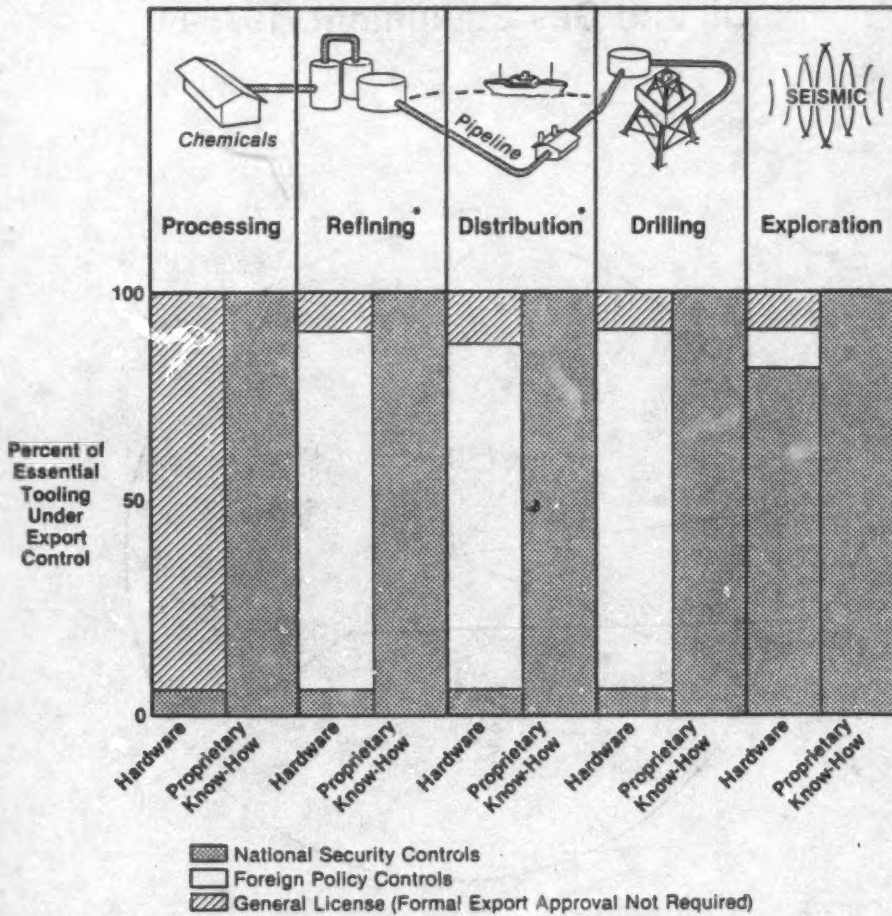
The USSR possesses vast, unexploited reserves of raw materials, but is deficient in technology and capital. In contrast, Japan and western Europe are resource poor and technology rich. They also are able to furnish the capital the USSR requires to accelerate the development of specific sectors of the economy.

We believe it is time to reduce the substantial direct and indirect contributions made by the West to the strategic capabilities of the USSR.

This Administration remains deeply apprehensive about the security implications of accelerated East-West economic and political integration. We believe that over the past ten years the Free World has concentrated its attention on the Soviet military threat, while remaining largely oblivious to the Soviet economic threat. We have failed to appreciate that under conditions of relative strategic equivalency the economic aspects of the East-West relationship may be a decisive factor.

This Administration has a clear perception of the dangers that lie ahead. We intend to manage the East-West commercial relationship in a way that protects vital national interests and reduces Soviet leverage over the economies of the West.

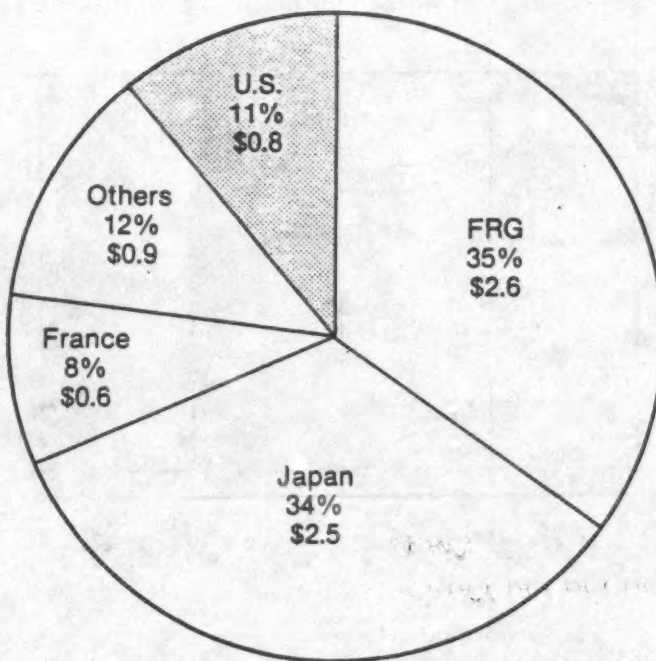
Chart 1.
Equipment for Gas/Oil:
Current Export Controls to U.S.S.R.



*President Reagan announced the extension of foreign policy controls covering distribution and refining equipment on December 29, 1981.

Source: U.S. Department of Commerce Estimates

Chart 2.
Soviet Orders for
Western Large Diameter Pipe and
Oil and Gas Equipment: 1976-80



\$7.4 Billion

Source: U.S. Government Estimates

Mr. GORE. Good.

We will try to get you out of here as quickly as possible, Mr. Secretary.

There have been recent reports from the Washington Post that the administration is considering putting restrictions on European licensees of U.S. patents to prevent them from exporting equipment manufactured under U.S. patents for use on the West Siberian pipeline.

Is this true?

Mr. OLMER. It is true, yes.

Mr. GORE. How would such a restriction be enforced? Would we be required to arrest officials of Alsthom-Atlantique, for example, if they exported turbines?

Mr. OLMER. Well, I think without attempting to provide you with a legal opinion as to the method of enforcement, let me say that there are areas of our laws that have been historically applied extraterritorially.

In some cases, foreign governments have objected to the application of our laws extraterritorially but we have never, to my knowledge, at any rate, accepted the legitimacy of their efforts to stop the application of our laws at our border.

How the laws would be enforced, if that were the course of action the President chose to take, I am not prepared at this time to say.

I do think that we would strive mightily to achieve volunteerism on the part of our allies in a mutual recognition of the threat represented. We have not yet confronted whether or not that decision will be taken to apply our laws extraterritorially or what the consequences would directly be.

We are now in the process of both working with our allies and examining the legal aspects of that issue.

Mr. GORE. Well, volunteerism is being asked to carry a heavy burden both domestically and in foreign policy. You cite, for example, the agreement voluntarily of the allies not to pick up contracts dropped by U.S. companies.

However, we have a letter from the Caterpillar Tractor Co. to the President.

The letter says that the company, when it was cut off from its exports of pipelayers, the Komatsu Corp. in Japan, immediately picked up those contracts and sales.

Mr. OLMER. I think if we were to examine the chronology that that would not be exactly true, that the Komatsu deal had been undertaken prior to the imposition of sanctions by the Government and was concluded immediately in that interim period before the sanctions were applied.

I understand and share, in part, the concerns of the Caterpillar Corp. and do not have a good answer for the travail the corporation is currently going through.

But the thrust of your question, to my understanding of the dates concerned would not suggest that our efforts have failed.

Mr. GORE. Well, do we have assurances from the Japanese that they will not pick up contracts?

Mr. OLMER. We have assurances from the Japanese that they would make no further efforts in that regard to provide government financing to promote private sector sales.

And the particular sales that are the subject of the letter that you possess, I believe, were made pursuant to a government-subsidized financing deal.

Mr. GORE. But we do not have any assurances that they won't pick up contracts?

Mr. OLMER. We do not have any assurance that the Japanese Government will step in and stop a private company from making a private deal but we do have assurance that there will be no government financing involved in whatever deal might be developed.

Mr. GORE. What about the role of U.S. oil companies in the pipeline? Has there been any discussion at all about their participation in this?

Mr. OLMER. Sure. I read the Washington Post article on Saturday and I think there were a couple of things that are faulty with the reasoning represented therein, most especially the line of argument that suggests that the oil company interests gives it a controlling interest in the behavior of a foreign government corporation.

We are talking about the West German Government which has the ownership control and direction that it is involved in telling Ruhrgas and France du Gas what to do.

The minor equity interest of the U.S. multinational oil company does not go to corporate decisionmaking, is my understanding.

Mr. GORE. I see.

In some ways that is analogous to the minor percentage equipment and technology controlled by the United States that is critical to this pipeline?

Mr. OLMER. Not quite. We are talking about the sale by a private company to a foreign government of a discrete product and not the purchase by a foreign government of gas from another foreign government, in which contract a multinational U.S. corporation has a minor interest.

Mr. GORE. When do you expect a decision to be made on restricting European licensees of American patents or attempting to?

Mr. OLMER. I believe it will be made very shortly within the next week or so.

Mr. GORE. Within the next week or so?

Mr. OLMER. Yes.

Mr. GORE. And you believe such a restriction could be enforced?

Mr. OLMER. I believe that the Export Administration Act of 1979 and the historical application of the Commerce Department of those regulations is, as for example, in any boycott legislation, and in application of foreign policy, human rights restraints, would enable us, in most situations I can envision, to apply the law and restrain those sales.

There are some discrete areas which could be involved that are, I am told by learned counsel, are gray areas. But that would not go to, at this point in our mind, to the inability of the President to direct those actions be taken.

Mr. GORE. What do you expect the reaction of our Western allies to be to such a move?

Mr. OLMER. I suspect that it would be one of great concern for our effort to apply extraterritorially U.S. laws and regulations. Those are concerned which have been represented to us before and

we have attempted to deal with them on a case-by-case basis expressing both sympathy and understanding of their point.

But like many legal actions in this litigious society, we learn to live with dispute and that does not make us any less forthcoming in our larger relationship. And I would hope that that kind of attitude might prevail.

Mr. GORE. Do you think that the trade-off is in the best interest of the United States? By that I mean the trade-off between damage done to the Western Alliance during a time of widening debate over NATO's future shape and role on the one hand, and the uncertain prospects for really having any impact at all on the timetable or cost of constructing the pipeline on the other hand?

Mr. OLMER. Mr. Chairman, there are a number of considerations that pertain to the issue and all of them have not been wrapped up in the way in which you phrase the question.

Moreover, we really are at a stage of deliberation and decision-making and it is a decision that the President will have to take.

I feel confident to give you my own personal opinion but I believe that it will take a decision that will represent United States' best interests.

Mr. GORE. Well, I do not want to put you on the spot but we have been at this for quite some time and every time we address the issue it seems like the debate is ongoing and the decision has not been reached yet.

But from the point of view of the Commerce Department, do you think that that trade-off is a positive one for us?

Mr. OLMER. From the point of view of the Commerce Department, I can only tell you that in applying the law we think we have the authority as we have historically employed it to restrain all but a small component part of the things that are involved.

I really would not want to comment on what is the province of the Secretary of State or Secretary of Defense to bring to bear. But let me tell you that there are other potential avenues in which we are currently exploring that I believe represent the possibility of substantially constraining the completion of that pipeline.

Mr. GORE. What are they?

Mr. OLMER. Well, from a technical point of view it may be reasonable to conclude that the pipeline could not be efficiently operated with less than a full complement of compressors and that were we to restrain the sale of compressors presently in the United States, for example, that that would, of itself, forestall completion of the pipeline at an operating rate that seems to have been engineered into it.

That is probably a technical decision and it needs further examination. It is a technical proposition.

Mr. GORE. As I understand it, OTA has concluded that, No. 1, there are foreign manufacturers of those compressors but; No. 2, that might be a factor that would slow down somewhat the construction of the pipeline but would not prevent the construction of the pipeline.

Do you agree with their assessment on that?

Mr. OLMER. Well, it is an easy judgment to make that it will slow it down. A lot is going to slow it down.

We have talked, personally, to a number of U.S. manufacturers of pipe with extensive experience in Arctic conditions who have made the judgment that it is almost beyond their comprehension to think the pipeline as presently estimated by the Russians will begin delivering gas in 1984 or 1985.

It is going to take far longer giving their experience in Arctic conditions and with the Soviet Union in construction process. That is one calculation we are trying to come to grips with and I hope we will have some answers within a week and that process is going to engage us in discussion with our allies.

Mr. GORE. So this week you expect to come to some resolution?

Mr. OLMER. It is my hope that it will be this week. I cannot assure it but we are going to try.

Mr. GORE. I recognize my colleague, Mr. Walker.

Mr. WALKER. Thank you, Mr. Chairman.

My only observation to the fact that our companies commenting on that may be wrong is it seems to me that they have not had much experience working with slave labor and that may be a factor in speeding up the timetable.

I am also concerned about the fact that at least in the perception much of the work that has been done thus far in sanctions has appeared to be more bilateral than multilateral.

Now, I appreciate your testimony here today indicating that there is far more cooperation than might appear on the surface with some of this but the fact is the perception is out there that there is essentially a bilateral sanction rather than a cooperative Western sanction.

Do I understand, then, correctly, that the attempt to freeze U.S. patents or make them a part of the sanction policy is an attempt to bring a more concerted Western effort into this at least insofar as we can influence?

Mr. OLMER. Absolutely, yes.

Mr. WALKER. And am I also understanding that at the present time we do feel that we have agreements in place that would assure our companies that any further contracting done will not be any contracting that supplants what was previously going to be contracted with this country?

Mr. OLMER. I am not sure I understand your question, Congressman.

Mr. WALKER. Well, I am getting back to the Caterpillar situation to some extent as well. If I understood you correctly, we have government-by-government agreements at the present time that insofar as they can influence contracting out of their country, they will cooperate and make certain that any U.S. contracts will not be supplanted by contracts from their own country?

Mr. OLMER. No, sir, I did not mean to suggest that, that is sort of comprehensive. We are still pursuing that. It has been done on a case-by-case basis. To my own personal knowledge we have been given the limited assurance that I have indicated previously which would apply to the offering of government financing subsidies to consummate a sale.

Mr. WALKER. And is that true of the entire Western Alliance at this point?

Mr. OLMER. No, sir, it is not.

Mr. WALKER. Could you detail for us which countries either are participating or are not participating?

Mr. OLMER. I do not have that information presently and I believe that it would be a matter that we would prefer to keep confidential. We would certainly be willing to share it with you in some private forum to the extent it is presently available but we are working on that area right now.

It is not to suggest that we don't have that kind of agreement. It is just that we are in the process of working to obtain it.

Mr. GORE. Will the gentleman yield?

Mr. WALKER. Yes; I will be glad to yield to the Chairman.

Mr. GORE. That is confidential, the fact that our allies are not complying with a request that is essential if your plan is to work?

Mr. OLMER. Well, Mr. Chairman, I respectfully submit I do think it is a matter of the conduct of foreign policy in its process and I think that it would be detrimental to the pursuit of that.

Mr. GORE. Yes; but the nub of this whole issue is the administration has a plan. I am not saying just this administration. It is a tough issue for the country. You have a plan that will not work unless all of our allies that are capable of supplying the same technology and equipment agree to do what we have asked them to do.

You have testified here today that you have reason to believe that that may work. If the American people are not to have the wool pulled over their eyes and believe something that is not true that is that we have an effective way of stopping this pipeline in the absence of these agreements, then they have a right to know what kind of progress you are making and they have a right to know, I think which countries have agreed, without singling out those that have refused to agree, can you tell us those that have agreed and then we can subtract the others out?

Mr. OLMER. Mr. Chairman, at no time is my interest in seeing to it that the American people get all the information they are entitled to and I think they are entitled to it all, any less than yours.

But I did suggest that we are in the process of rather delicate negotiations and I don't think it would help the achievement of those objectives for me now to tell you who has and who has not.

Mr. GORE. Well, it might be embarrassing if no one had, for example; has anyone?

Mr. OLMER. Yes.

Mr. GORE. Which ones have?

Mr. OLMER. Well, I just said to you, sir, that I would rather not discuss who has and who has not.

Mr. GORE. More than one?

Mr. OLMER. Yes.

Mr. GORE. More than two?

Mr. OLMER. Mr. Chairman, the people's right to know has a limit.

Mr. GORE. Well, if we are really going to be successful in this effort I think we have to have more debate, more candor and more realism. And the administration, and, again, it is not unique to this administration but the administration has not been realistic about this and it is easier to defend a nonviable policy if it is cloaked in, not necessarily secrecy but obscurity.

Well, in this case it is secrecy. If it is, in fact, not a viable policy, let's admit that fact and then try to construct one that is viable.

One of the questions to answer is: Is this a viable policy? And if there are a number of exceptions among important allies to this general multilateral approach, then that makes the point that it is probably not a viable policy.

Thank you.

Mr. WALKER. Let me ask you this, is not there some point? I would agree with you that it is tough to release a lot of information in the course of negotiations. That probably frustrates negotiations as much as it helps negotiations. I understand your point. But is not there a point when the American people have a right to know who our friends really are and who in the Western alliance is going to back these policies along the way?

It seems to me at some point the negotiating has to stop and the facts have to be put on the table.

Mr. OLMER. I agree completely.

Mr. WALKER. I would certainly hope that we are going to, at some point, decide that those who are participating ought to be praised for that participation by letting the American people know who is cooperating with us.

The subsidies that you talk about, seems to me to be a rather limited response on the part of those who have obviously already agreed.

How critical are those in terms of sales to the Soviets?

Mr. OLMER. Well, in the particular case in point I responded to a question from the chairman that concerned the sale of pipelayers from Japan. Pipelayers are not strategic equipment. They are controlled by the United States for foreign policy reasons and thus it would be difficult for us, certainly at this point I think it would complicate our efforts to achieve agreement in a more limited frame to attempt to extend acceptance of controls to pipelayers, thereby enabling the Government to step in and say, a license for that piece of equipment is required.

Mr. WALKER. Well, then the answer to my question is that the subsidies are not particularly critical on a number of elements of contractual relations that might be developed by businesses in this country?

Mr. OLMER. Well, the question of subsidy is not critical certainly in this country and I don't think it critical in most countries for those items which we deem most critical to the completion of the pipeline.

Mr. WALKER. So, in fact then, what we have gotten from our allies then thus far is an extremely limited response to multilateral cooperation on sanctions.

Mr. OLMER. I don't agree, sir. I think we have gotten at least the beginnings of what we hope will be a wider willingness to share the burden and that that is a hopeful sign and we are going to have to work harder on it.

Mr. WALKER. Let me put the question this way: If I understand what you are saying then, do the subsidies then become critical because the Soviets do not have sufficient hard currency to finance the sales without the subsidies?

Mr. OLMER. Well, in the particular case in point we are looking at a rather substantial sale I think it may have approximated \$1 billion in its size, therefore, the subsidy became a critical element because of limits on Soviet hard currency availability.

Mr. WALKER. Well, that follows into the other line of questioning that I would like to pursue with the chairman's indulgence just for a moment. What I don't understand in the totality of this policy, then, is why we are bailing out the Soviet hard currency concerns by going ahead and paying off the Polish debt at a time when we could put additional pressure on the hard currency concerns of the Soviet Union by doing something to assure that the Soviet Union has to come to the rescue of that government rather than our Government coming to the rescue.

Where is the consistency in the policy in that regard?

Mr. OLMER. I think I will defer to my State Department colleague who will shortly take my place to respond to your question about consistency in our foreign policy.

I would like to say, however, that as I have read the decision on the credit issue, we do believe that it continues and extends the pressure on the Polish Government and on the Soviet Government by continuing the obligation to pay and not hasten default and that the option will be there 3 months from now to look at the question again.

Mr. WALKER. So, is our study judgment at this present time based upon the analysis that you have seen that the Soviet Union would indeed allow the Polish Government to default rather than to help them to pay off loans as they come due?

Mr. OLMER. I don't think anyone has an answer to that question, Congressman. I really don't.

Mr. WALKER. But it becomes a crucial judgment in the policy that we are pursuing. It sounds to me as though we have come down on the side that at least we believe that the Soviet Union would allow the Polish Government to default?

Mr. OLMER. You are asking me a question that gets into the area of the State Department and I really would like to defer on that issue.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. GORE. Well, thank you. And again on the question of restricting licensees, you expect a decision to be made on that within the week?

Mr. OLMER. I am hopeful that we will get a decision within a week on that subject.

Mr. GORE. And at that point you are not certain whether it could be enforced in all cases but you think that in some cases it could be enforced although it would incur the ill feeling of our allies.

Mr. OLMER. On the one hand, we have lawyers that will say that the law is sufficiently clear to enable us to apply the sanctions, extraterritorially even as regards any complicated and discrete area of those controls.

I do think that there may be some price to pay for it and part of the decisionmaking process will be to determine how high the price is and whether or not we are willing to pay it.

Mr. GORE. Well, we will look forward with anticipation to the results of those deliberations.

Thank you again for coming and we will have further questions for your assistant in the next panel.

Mr. OLMER. Thank you.

Mr. GORE. Let me say that we are going to have to recess for about 10 minutes and then we will come back with the final panel of witnesses from the Defense Department and the State Department joined by the witness from the Department of Commerce. We will recess for 10 minutes.

[Brief recess.]

Mr. GORE. The subcommittee will come back to order.

I would like to welcome our witnesses, Dr. Stephen Bryen, Deputy Assistant Secretary for International Security Affairs with the Department of Defense, Hon. Ernest Johnston, Deputy Assistant Secretary for Economic and Business Affairs for the Department of State, and joining them at the panel for responding to questions is the Honorable Bo Denysyk, Deputy Assistant Secretary for Export Administration, Department of Commerce.

Your statements will be put into the record. At this point we invite you to proceed. We would like to hear first from Dr. Stephen Bryen.

STATEMENTS OF HON. ERNEST JOHNSTON, DEPUTY ASSISTANT SECRETARY FOR ECONOMIC AND BUSINESS AFFAIRS, U.S. DEPARTMENT OF STATE; HON. STEPHEN BRYEN, DEPUTY ASSISTANT SECRETARY FOR INTERNATIONAL SECURITY AFFAIRS, U.S. DEPARTMENT OF DEFENSE; AND HON. BO DENYSYK, DEPUTY ASSISTANT SECRETARY FOR EXPORT ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. BRYEN. Thank you, Mr. Chairman, but I suggest that we start with Mr. Johnston, and I will follow right behind him, if that would be OK with you.

Mr. GORE. It does not matter a great deal. That will be fine with us.

Mr. Johnston from the State Department, please proceed.

Mr. JOHNSTON. I would like to give a summary of the statement that you will include in the record. The OTA report came out at a very timely moment. It was issued shortly after our discussions last fall with the Europeans on the West Siberian gas pipeline which, of course, is the largest and single most visible example of Western equipment and technology associated with Soviet energy development. Its release also came at a time when the administration was studying a new policy on exports to the Soviet Union of oil and gas equipment and technology.

Since that time, events in Poland took a dramatic turn for the worse and caused us to invoke strong measures against the Soviet Union. One of these actions was to stop oil and gas equipment and technology exports to the Soviet Union. We have asked our allies to take parallel measures and not to undercut the actions we have taken in response to martial law in Poland.

Energy production is important to the Soviets not only for their domestic use but also for export earnings. I will limit my remarks this morning to the oil and gas sectors of energy because these are

the most important sources for Soviet energy consumption and for Soviet exports.

The Soviet Union will seek to import large volumes of Western equipment and technology as it endeavors to develop and exploit its oil and gas reserves in the coming decades. Even under the most optimistic assumptions about the level of Soviet oil and gas production, it is clear that the days of easy Soviet access to cheap reserves are rapidly drawing to a close.

New reserves, especially in the all-important gas sector, are far from major population and industrial centers. This geographic shift, primarily to the West Siberian region, means that the construction of new gas pipelines will be necessary. The Soviets now depend on Western equipment imports for the key components in pipeline construction—especially large-diameter pipe and compressor stations to drive the gas through the pipes. While much of the Soviet equipment imports are not particularly advanced technologically, Soviet indigenous production is currently inadequate to meet Soviet needs, in terms of both quantity and quality.

Perhaps the most notable finding of the OTA study is that the United States alone has little leverage to reduce current and future development of Soviet oil and gas. The study reports that there is no single essential energy equipment or technology area in which the U.S.S.R. must depend on the United States for the long run. In areas where the Soviets now rely on Western imports, there is equipment and technology available outside this country. The OTA study points out that foreign firms, through research and development, have independently developed their own oil and gas equipment and technology capabilities.

The United States does retain an edge in some oil and gas equipment and technology areas. The OTA study notes that the United States is the sole or preferred supplier in a number of areas, including integrated computer systems and software, submersible pumps, blow-out preventers, and tertiary recovery techniques. But the Soviet Union in recent years has shown a definite reluctance to purchase U.S. energy equipment because of the possibility of export control problems. For instance, the United States has sold no submersible pumps to the Soviet Union since 1978.

Although the United States may have some delaying possibilities, we cannot markedly reduce the volume or increase the cost of Soviet energy production through unilateral export controls. However, the West acting in a concerted manner could have a significant effect.

Before discussing possible Western policies toward Soviet oil and gas development, it is important to describe fully the differences of view between the United States and our allies on the desirability of increased Soviet energy production and expanded East-West energy ties in those areas.

The European perspective is different from ours for a number of reasons. In the first instance, the Europeans are more dependent on imported energy sources than are we. They import approximately two-thirds of their energy needs, whereas we import only about one-fifth of what we need. Further, given a strong desire to reduce their heavy dependence on Middle Eastern energy imports and to diversify their supplies, and given the Soviet Union's relative prox-

imity to Europe, they view the Soviet Union as an acceptable supplemental supplier. This view is reinforced by the continuing European belief that energy and other trade links with the Soviets serve to moderate Soviet international behavior.

Another key ingredient in the European and Japanese perspective on Soviet oil and gas development is the opportunity for related energy equipment trade.

These energy, economic, and political factors behind our allies' view of Soviet energy development are, needless to say, not entirely shared by the United States.

These differences in view are not easily bridged. But this administration is committed to working with our allies to insure that excessive Western dependence on Soviet energy does not develop. In this context, I will briefly discuss the West Siberian pipeline and its implications for Western energy security.

In our discussions with European governments on the pipeline, we have focused on the energy security impact of increased West European reliance on Soviet energy sources. We have stressed the vulnerabilities which could arise from increased imports of Soviet gas, and have emphasized that the volume of energy imports from the Soviet Union is not in itself a sufficient indicator of potential economic and political vulnerability that could arise from expanded energy ties.

Although the six European participants in the pipeline project will be dependent on the U.S.S.R. for only approximately 6 percent of their total energy needs once the pipeline is fully operational, we feel the Europeans must look beyond the aggregate numbers to more fundamental energy security considerations: First, gas—which is rapidly replacing oil as the chief Soviet hard currency earner—is a difficult fuel to replace in the event of a supply interruption, much more difficult to replace than oil.

Second, certain regions within Europe will be heavily dependent on Soviet gas once the pipeline is completed.

Third, residential and commercial consumers will be particularly dependent on Soviet gas, and a cutoff in these sectors would occasion special and most troublesome domestic political problems and pressures.

We argue that even without a cutoff of Soviet energy flows, the Soviets will possess leverage which could be brought to bear on Western European governments.

In addition to these energy security considerations, we have pointed out that the economics of the pipeline are no longer as attractive as they were when initial negotiations began in 1978. Overall energy growth rates are down, and European gas demands are now being revised downward.

For these reasons, we are continuing to discuss with the Europeans alternatives to the West Siberian project which we believe are more economic and more secure.

In response to our concerns, the Europeans have been firm in characterizing our alternative energy sources as supplementing—but not replacing—increased energy imports from the Soviet Union. But the Europeans have gained through our discussions a better appreciation of the risks inherent in East-West energy trade.

Even before we recently stopped shipments of oil and gas equipment and technology exports to the Soviet Union, we were the only Western country to control the export of such items to the U.S.S.R.

Our unilateral controls can have only a limited effect. In this regard, foreign sources for all equipment and technology required for the West Siberian gas pipeline are either already available or could be developed quickly enough so as not to delay significantly a realistic schedule for putting that project into operation. Therefore, substantial allied cooperation would be needed to deprive the U.S.S.R. of Western equipment and technology.

The OTA study notes that our sanctions program following the Soviet invasion of Afghanistan demonstrated the problems of our allies in imposing trade controls in areas, such as energy, which do not have direct Soviet military applications. Our allies' problems are clearly exacerbated when the incentive of equipment sales to the U.S.S.R. and the goal of energy diversification are added to the equation.

In spite of the problems of developing with our allies a multilateral control policy on oil and gas equipment and technology exports to the Soviet Union, our own policy in this area is not and should not be based entirely on our allies' perceptions. We have a leadership as well as a partnership role in the alliance. We cannot forge consensus without taking steps ourselves.

Achieving allied cooperation in meeting the problems posed by both Western oil and gas imports from the Soviet Union and oil and gas equipment technology exports to the Soviet Union will not be easy. Our experience with the West Siberian gas pipeline has demonstrated that we have large differences of view with the Europeans. But we shall continue to work cooperatively with our allies to lessen the risks of excessive dependence and potential vulnerability that could stem from Western imports of oil and gas. Both for now and the most distant future, we must strive to achieve a multilateral approach toward Soviet oil and gas development that will strengthen the alliance.

Thank you, sir.

[The prepared statement of Ernest B. Johnston, Jr., follows:]

STATEMENT OF ERNEST B. JOHNSTON, JR., DEPUTY ASSISTANT SECRETARY OF STATE FOR
ECONOMIC AND BUSINESS AFFAIRS

INTRODUCTION

I suspect that the drafters of the OTA study on "Technology and Soviet Energy Availability" did not anticipate how timely their work would prove to be. Their report was issued shortly after our discussions last fall with the Europeans on the West Siberian gas pipeline which, of course, is the largest and single most visible example of Western equipment and technology associated with Soviet energy development. Its release also came at a time when the Administration was studying a new policy on exports to the Soviet Union of oil and gas equipment and technology.

Since that time, events in Poland took a dramatic turn for the worse and caused us to invoke strong measures against the Soviet Union. One of these actions was to stop oil and gas equipment and technology to the Soviet Union. We have asked our allies to take parallel measures and not to undercut the actions we have taken in response to martial law in Poland.

Energy production is important to the Soviets not only for their domestic use but also for export earnings. I will limit my remarks this morning to the oil and gas sectors of energy because these are the most important sources for Soviet energy consumption and for Soviet exports.

The Soviet Union will seek to import large volumes of Western equipment and technology as it endeavors to develop and exploit its oil and gas reserves in the coming decades.

Even under the most optimistic assumptions about the level of Soviet oil and gas production, it is clear that the days of easy Soviet access to cheap reserves are rapidly drawing to a close.

New reserves, especially in the all-important gas sector, are far from major population and industrial centers. This geographic shift, primarily to the West Siberian region, means that the construction of new gas pipelines will be necessary. The Soviets now depend on Western equipment imports for the key components in pipeline construction—especially large-diameter pipe and compressor stations to drive the gas through the pipes. Which much of the Soviet equipment imports are not particularly technologically advanced, Soviet indigenous production is currently inadequate to meet Soviet needs, in terms of both quantity and quality.

Perhaps the most notable finding of the OTA study is that the United States alone has little leverage to reduce current and future development of Soviet oil and gas. The study reports that there is no single essential energy equipment or technology area in which the U.S.S.R. must depend on the United States for the long run. In areas where the Soviets now rely on Western imports, there is equipment and technology availability outside this country. The OTA study points out that foreign firms, through research and development, have independently developed their own oil and gas equipment and technology capabilities.

The United States does retain an edge in some oil and gas equipment and technology areas. The OTA study notes that the United States is the sole or preferred supplier in a number of areas, including integrated computer systems and software, submersible pumps, blow-out preventers, and tertiary recovery techniques. But the Soviet Union in recent years has shown a definite reluctance to purchase U.S. energy equipment because of the possibility of export control problems. For instance, the United States has sold no submersible pumps to the Soviet Union since 1978.

Although the United States may have delaying possibilities, we cannot markedly reduce the volume or increase the cost of Soviet energy production through unilateral export controls. However, the West acting in a concerted manner could have a significant effect.

Before discussing possible Western policies towards Soviet oil and gas development, it is important to describe fully the differences of view between the United States and our allies, on the desirability of increased Soviet energy production and expanded East-West energy ties in those areas.

The European perspective is different from ours for a number of reasons. In the first instance, the Europeans are more dependent on imported energy sources than are we. They import approximately two-thirds of their energy needs, whereas we import only about one-fifth of what we need. Further, given a strong desire to reduce their heavy dependence on Middle Eastern energy imports and to diversify their supplies, and given the Soviet Union's relative proximity to Europe, they view the Soviet Union as an acceptable supplemental supplier. This view is reinforced by the continuing European belief that energy and other trade links with the Soviets serve to moderate Soviet international behavior. It is also reinforced by the perception that European purchases of Soviet oil and gas finance Soviet imports of European technology and manufactured goods.

Another key ingredient in the European and Japanese perspective on Soviet oil and gas development is the opportunity for related energy equipment trade.

These energy, economic, and political factors behind our allies' view of Soviet energy development are, needless to say, not entirely shared by the United States.

These differences in view are not easily bridged. But this Administration is committed to working with our allies to ensure that excessive Western dependence on Soviet energy does not develop. In this context, I will briefly discuss the West Siberian pipeline and its implications for Western energy security.

In our discussions with European governments on the pipeline, we have focused on the energy security impact of increased West European reliance on Soviet energy sources. We have stressed the vulnerabilities which could arise from increased imports of Soviet gas, and have emphasized that the volume of energy imports from the Soviet Union is not in itself a sufficient indicator of potential economic and political vulnerability that could arise from expanded energy ties.

Although the six European participants in the pipeline project will be dependent on the USSR for only approximately six per cent of their total energy needs once the pipeline is fully operational, we feel the Europeans must look beyond the aggregate numbers to more fundamental energy security considerations:

First, gas, which is rapidly replacing oil as the chief Soviet hard currency earner, is a difficult fuel to replace in the event of a supply interruption, much more difficult than oil.

Second, certain regions within Europe will be heavily dependent on Soviet gas once the pipeline is completed.

Third, residential and commercial consumers will be particularly dependent on Soviet gas, and a cut-off in these sectors would occasion special and most troublesome domestic political problems and pressures.

We argue that even without a cut-off of Soviet energy flows, the Soviets will possess leverage which could be brought to bear on Western European governments.

In addition to these energy security considerations, we have pointed out that the economics of the pipeline are no longer as attractive as they were when initial negotiations began in 1978. Overall energy growth rates are down, and European gas demands are now being revised downward.

For these reasons, we are continuing to discuss with the Europeans alternatives to the West Siberian project which we believe are more economic and more secure.

In response to our concerns, the Europeans have been firm in characterizing our alternative energy sources as supplementing—but not replacing—increased energy imports from the Soviet Union. But the Europeans have gained through our discussions a better appreciation of the risks inherent in East-West energy trade.

Even before we recently stopped shipments of oil and gas equipment and technology exports to the Soviet Union, we were the only Western country to control the export of such items to the U.S.S.R.

Our unilateral controls can have only a limited effect. In this regard, foreign sources for all equipment and technology required for the West Siberian gas pipeline are either already available or could be developed quickly enough so as not to delay significantly a realistic schedule for putting that project into operation. Therefore, substantial allied cooperation would be needed to deprive the USSR of Western equipment and technology.

The OTA study notes that our sanctions program following the Soviet invasion of Afghanistan demonstrated the problems of our allies in imposing trade controls in areas, such as energy, which do not have direct Soviet military applications. Our allies' problems are clearly exacerbated when the incentive of equipment sales to the U.S.S.R. and the goal of energy diversification are added to the equation.

In spite of the problems of developing with our allies a multilateral control policy on oil and gas equipment and technology exports to the Soviet Union, our own policy in this area is not and should not be based entirely on our allies' perceptions. We have a leadership as well as a partnership role to play in the alliance. We cannot forge consensus without taking steps ourselves.

Achieving allied cooperation in meeting the problems posed by both Western oil and gas imports from the Soviet Union and oil and gas equipment technology exports to the Soviet Union will not be easy. Our experience with the West Siberian gas pipeline has demonstrated that we have large differences of view with the Europeans. But we shall continue to work cooperatively with our allies to lessen the risks of excessive dependence and potential vulnerability that could stem from Western imports of oil and gas. In the near term, our allies have said they will not undermine our sanctions on exports to the U.S.S.R. Both for now and the more distant future, we must strive to achieve a multilateral approach towards Soviet oil and gas development that will strengthen the alliance.

Mr. GORE. Thank you very much. We will withhold questions until Dr. Bryen has completed his statement.

Mr. BRYEN. I would like to submit my statement for the record. I think as far as summary is concerned, let me just pick out a few points, some of which have already been mentioned but maybe not highlighted sufficiently.

As you know, the Defense Department has expressed its apprehensions about the effects of Soviet gas exports before the Congress, and we have expressed our views to our European allies as well. Our concern about the West Siberian pipeline is with the financial bonanza the export of energy, especially gas, in the eighties and nineties represents for the Soviet Union. The approximately 1.4 trillion cubic feet per year the Soviets will export to Western Europe over the next 25 years will be worth close to \$200 billion.

About one-quarter of Western European gas supplies will flow out of the Soviet Union, and in the case of West Germany we expect it to be about 30 percent of her gas supplies.

These earnings will be a tremendous boost to the sagging Soviet economy, which is plagued by mismanagement, labor shortages, bad weather, staggering military spending, economic collapse in East Europe, and disappointments in the energy sector itself. The \$8 billion or so in hard currencies earned each year by the pipeline project will assist the Soviets we think in purchasing much-needed Western commodities, including, I might add, sophisticated Western technology to support both its industrial base and its military apparatus.

Beyond the direct contribution to the Soviet treasury are the indirect benefits in the form of political and economic influence in the West that accrue to the Soviets through East-West energy trade. The OTA study does a good job we think in documenting the growth and political economic impact of this trade. The study observes although the focus of much of the discussion between the United States and the Federal Republic of Germany about the West Siberian pipeline has been energy imports, the primary incentive for West Germany has been equipment exports. For West German firms such as Mannesman Steel Works, which last year exported to the Soviet Union 60 percent of the large-diameter pipe it produced, the West Siberian pipeline represents the latest and largest in a long series of pipeline projects which help it to employ a few thousand workers. In fact, many West German Government and business spokesmen generally view East-West trade as mutually beneficial, and the West Siberian project is particularly attractive because of the jobs it is likely to create. It is not surprising, the study observes, that West German steel firms, including state-owned Salzgitter, have actively lobbied for the project.

We are also concerned that the lobby created for harmonious relations with the Soviets by this project in business, government, and among consumers will weaken the resolve of the European members of the NATO Alliance to respond adequately to Soviet challenges to Western independence both in times of quiet and crisis.

We are well aware, as the OTA study points out, that not all Western nations have shared our apprehensions to the same degree. We feel, however, that this stems from differing experience with dependence on foreign energy sources and a slower reading of the changing international energy scene.

Ernie has already told you that the European nations have been much more dependent than the United States on the politically volatile Middle East oil-producing region. The 1973 and 1979 price and supply shocks stimulated them to look for other types of fuels and other regions for supplies of energy. Natural gas was an obvious and attractive choice, and the Soviet Union, holding one-third of known world reserves, seemed like a natural supplier. There was the additional hope that expanded East-West trade would build political and economic bridges to the Soviet Union that would be mutually beneficial in both commercial and geopolitical terms.

In the last 2 years the United States has come to realize the erroneous basis of this perspective. East-West trade has not moderat-

ed Soviet behavior, be it in Afghanistan, Poland, or on SS-20 deployment aimed at Western Europe. Natural gas has not proved the answer to Europe's energy problems. Indeed, natural gas demand in West Europe declined last year for the first time in modern memory. The Soviet Union, far from being a supplier of cheap energy, turns out to be at best marginally competitive in terms of delivered prices.

We believe that if the Europeans factored in all the costs of importing Soviet natural gas—including the expensive measures necessary to insure against politically induced or technically caused supply interruptions, military spending to offset Soviet technology acquisitions made possible by gas sales, and interest-rate subsidies for pipeline construction costs—the pipeline project would prove financially unattractive to them.

I think at this point, Mr. Chairman, let me just highlight one point that I thought was especially interesting in Mr. Olmer's comments to you, and Mr. Johnston mentioned it. This is the question of delaying the pipeline and the consequences. I think it is true that if the United States withheld technology and equipment we would have some impact on the timetable for the construction of the pipeline. If we did that with our allies, there would be even more impact.

Timing is awfully important in all this. These gas deliveries I believe are scheduled to come in in the middle of the eighties if it was on schedule. As has been mentioned this morning, everyone we have spoken with does not believe it can be done by the middle eighties. The project will stretch possibly into the nineties before it is completed. If the demand curves and all the projections that have been made on the need for gas are right, we may be seeing a tremendous multibillion-dollar investment by our allies for natural gas that will not be delivered when they need it, and we have suggested to them that other alternatives in more stable places might be far more desirable.

There may not be one single alternative that would replace the West Siberian pipeline. We may have to go to a number of different suppliers to make up the difference, but where we could have some assurance of getting the job done roughly on schedule, and that is the kind of debate and dialog we would very much like to have with our allies at this stage.

With that much said, I will reserve for questions.

[The prepared statement of Stephen Bryen follows:]

PREPARED STATEMENT OF STEPHEN D. BRYEN, DEPUTY ASSISTANT SECRETARY OF
DEFENSE FOR INTERNATIONAL ECONOMIC, TRADE AND SECURITY POLICY

Mr. Chairman: I am pleased to appear before this committee today to present the views of the Department of Defense on the topic of Soviet energy development. The strategic significance of Soviet energy availability and the contribution that Western technology and equipment makes to it is a matter of great concern to the Department of Defense. These issues have been brought most sharply into focus by the announcement of a massive project to pipe natural gas from deep within the Soviet Union to homes and factories in Western Europe. This project, which would not exist without Western equipment and financing, clearly demonstrates the challenges to our national security and, indeed, the integrity of the Atlantic alliance posed by Soviet energy development, particularly in the hydrocarbon sector.

Since one of the purposes of this hearing is to assist in committee's review of the recent Office of Technology Assessment [OTA] study entitled "Technology and

Soviet Energy Availability," I will try to key my remarks to that document when possible. Let me first take up the question of the importance of United States and other Western technology and equipment to Soviet energy development. As the OTA study notes, in 1979 about one-fourth of all Soviet trade with its major Western trading partners was in the area of energy technology and equipment, that is around \$3.4 billion. Most of this, \$2.7 billion, was for Moscow's oil and gas industries. We agree with OTA's conclusion that "There is no question that Soviet oil production has been assisted by American and other Western technology and equipment, although the impact of this assistance is impossible to quantify." (Emphasis in text) but even more important in our view, because of the hard currency earnings potential and the political and economic influence it bestows to Moscow, is the impact of Western exports to the U.S.S.R. on the natural gas sector.

OTA concluded "The one area in which Soviet petroleum equipment and technology purchases might be described as "massive" is large diameter pipe and other equipment for the construction and operation of gas pipelines. There is no evidence that reliance on the west in this area will lessen in the present decade. Indeed, given the crucial importance of increased gas production and gas exports to the short- and medium-term Soviet energy future, there is reason to believe that such dependence will increase." (Emphasis in text) returning to the West Siberian natural gas pipeline project as an example, all the large diameter pipe and compressor stations. Much of the nonpipe equipment was to be either directly or indirectly of U.S. design or manufacture. Our analysis shows that this equipment would make a highly significant, if not critical, contribution to the success or failure of the project.

Prior to December 30, 1981 little of this equipment, aside from certain electronics controlled under strategic trade restrictions, required a validated license for export. Likewise, it did not require review by the multilateral COCOM group before sale to the U.S.S.R. Under then existing regulations, therefore, there was little the Department of Defense could do to restrict access of the Soviet Union to this equipment at the present time. As a result of the Soviet backed repression in Poland, the President placed all oil and gas equipment and technology for export to the Soviet Union under validated licensing control, for foreign policy reasons. No such licenses are currently being issued. The Department of Defense endorses this more as an effective and appropriate response to the events in Poland. It will bring home to Moscow the costs of its actions in Poland.

The Defense Department has expressed its apprehensions about the effects of these exports before Congress and to our European allies. Our first concern is with the financial bonanza the exports of energy, particularly natural gas in the eighties and nineties, represents to the Soviet Union. The 1.4 trillion cubic feet per year the Soviets will export to Western Europe over the next 25 years will be worth close to \$200 billion dollars. (About one-quarter of Western Europe's gas supplies will flow out of the Soviet Union. West Germany will depend on Moscow for fully 30 percent of its supplies.) These earnings will be a tremendous boost to the sagging Soviet economy, plagued by egregious mismanagement, labor shortages, bad weather, staggering military spending, economic collapse in East Europe, and disappointments in the energy sector. The \$8 billion or so in hard currencies earned each year by this project will assist the Soviets in purchasing much needed Western commodities and sophisticated technologies to support its industrial base and military machine.

Beyond the direct contribution to the Soviet treasury are the indirect benefits in the form of political and economic influence in the West that accrue to Moscow through East-West energy trade. The OTA study does a good job in documenting the growth the politicoeconomic impact of this trade. For instance it observes that:

"Although the focus of much of the discussion between the United States and the FRG about Yamburg has been energy imports, the primary incentive for West Germany has been equipment exports. For West German firms such as Mannesman Steel Works, which last year exported to the Soviet Union 60 percent of the large-diameter pipe it produced, the West Siberian Pipeline represents that latest and largest in a long series of pipeline projects which help it [sic] to employ a few thousand workers. In fact, many West German Government and business spokesman generally, view East-West trade as mutually beneficial, and the West Siberian Yamburg, project is particularly attractive because of the jobs it is likely to create. It is not surprising the study observes, that West German steel firms, including state-owned Salzgitter, have actively lobbied for the project." We are also concerned that the lobby created for harmonious relations with the Soviets by this project in business, government, and among consumers will weaken the resolve of the European members of the NATO alliance to respond adequately to Soviet challenges to Western independence both in times of quiet and crisis.

We are well aware, as the OTA study points out, that not all Western nations have shared our apprehensions to the same degree. We feel, however, that this stems from differing experience with dependence on foreign energy sources and a slower reading of the changing international energy scene.

Ernie has already told you that the European Nations have been much more dependent than the United States on the politically volatile Middle East oil producing region. The 1973 and 1979 price and supply shocks stimulated them to look for other types of fuels and other regions for supplies of energy. Natural gas was an obvious and attractive choice and the Soviet Union, holding one-third of known world reserves seemed like a natural supplier. There was the additional hope that expanded east-west trade would build political and economic bridges to the Soviet Union that would be mutually beneficial in both commercial and geopolitical terms.

In the last 2 years the United States has come to realize the erroneous basis of this perspective. East-West trade has not moderated Soviet behavior be it in Afghanistan, Poland, or on SS-20 deployment aimed at Western Europe. Natural gas has not proved the answer to Europe's energy problems. Indeed, natural gas demand in West Europe declined last year for the first time in modern memory. The Soviet Union, far from being a supplier of cheap energy, turns out to be at best marginally competitive in terms of delivered prices.

We believe that if the Europeans factored in all the costs of importing Soviet natural gas—including the expensive measures necessary to insure against politically induced or technically caused supply interruptions, military spending to offset Soviet technology acquisitions made possible by gas sales, and interest rate subsidies for pipeline construction costs—the pipeline project would prove financially unattractive to them.

On the matter of financing, we believe that adding some \$10-\$15 billion in debt to the Soviet Union at this time by Western European banks passes the threshold of prudence. With the specter of Polish default staring us in the face we fail to see the logic of greatly increasing the East's debt to West through projects such as the West Siberian pipeline. If anything goes wrong with this project—and it is inherently risky given the size, complexity and time to completion—some West European banks could find themselves in a rather messy economic and political position. This concerns us because it is not only the Western banking system that is involved; there are governmental guarantees ultimately behind these financial arrangements. We don't want to see our NATO partners held hostage to a project that may be endangered by Soviet adventurism in East Europe or elsewhere.

We have been asked our views on the foreign availability question. In the present context we feel this issue is somewhat beside the point. Our allies have pledged not to undermine our sanctions and we fully expect them to honor that commitment. We do believe however, that the OTA study performs a valuable service in pointing out the muddle surrounding this whole concept. Too often limited foreign production of equipment and technology derived from U.S. innovations is cited as an excuse for dropping our controls on exports to the U.S.S.R. we see this as shortsighted and counterproductive. We must balance our long-term strategic national security concerns against short-term commercial interests. We cannot let the plight of individual firms faced with some foreign competition obscure the need to protect the security of 220 million Americans. On the other hand, an ambiguous policy that denies U.S. business the opportunity to compete in the international marketplace is not fair or sensible, either. We agree with OTA that a review of the foreign availability criteria is in order.

On the matter of Soviet energy production projections, we concur with OTA that it is not useful to search for correct predictions. The functions of these predictions is to guide policy, not fulfill prophecies. All the projections we have seen point toward the same general principles, however:

First, energy is the one bright spot in the otherwise dismal Soviet economy; second, energy exports, particularly natural gas, will be the most significant source of hard currency earnings to the Soviet union in this decade; third, Soviet energy supplies will continue to be a strong bond between Moscow and Eastern Europe; and fourth, the Soviet Union will continue to seek western technological assistance to develop its energy resources.

The ramifications of these trends will depend in large measure on the policies adopted by the United States and its allies. If we are careful we may be able to make the most of Soviet dependence on Western technology, limited Soviet leverage in Western Europe, encourage Eastern European reform and liberalization, and force the Soviets to confront the domestic economic consequences of their wanton military spending. If we are inattentive, all of these consequences may run in the other direction and we will all be poorer for it.

Thank you Mr. Chairman for this opportunity to review this important and timely topic. I would be happy to answer any questions you or the committee may have.

Mr. GORE. Thank you very much.

The Office of Technology Assessment I think has done a superb job here. They were really set up to assist the Congress in assessing the facts relating to technology as those facts affect a wide variety of issues so that in an era of accelerating technology and scientific developments, the Congress would not be flying blind, we would have someplace to look for expert assistance in assessing these facts. That is why we asked them to look at the facts underlying this issue, and I understand the fact that there has been a debate in the administration and there have been sharply held—sharply expressed points of view within the State Department, the Defense Department, and the Commerce Department.

I think that is fine to a reasonable limit. I think it is important that all the participants in that debate agree insofar as it is possible to agree on the facts which inform the debate. A hard-line position is one thing; an unrealistic position is quite another. And I would just like to begin the questions with you, Dr. Bryen, in asking you whether you agree, that with the OTA's assumption or finding that the United States acting alone cannot have a meaningful impact on the construction of the timetable—on the construction of the pipeline.

Mr. BRYEN. I am going to answer that in two ways. If it means that a pipeline can be constructed, I think the OTA is correct. That is say that I believe the pipeline can be built by the Soviets themselves without any help from the West. But I think that I have to caveat that appropriately. Some kind of pipeline can be built, but what are we looking at—

Mr. GORE. I think there would be disagreement about that.

Mr. BRYEN. They do make large-diameter pipe of their own, but it is not very good. They do make compressors of their own, but they have a smaller power. Some kind of pipeline can be built, because after all they are building pipelines in their country. But what we are looking at is a very efficient pipeline into Western Europe that will require considerable amounts of Western technology to complete. The OTA study notes that quite accurately, I believe. Now, the issue becomes if the United States cannot participate in any way, can the European countries do it themselves, and let us put aside whether we have leverage on issues such as the compressors, which are mainly under license from an American company.

Mr. GORE. The patent issue, yes.

Mr. BRYEN. But presumably it could be built, perhaps by the Europeans building their own turbines and compressors. I would say the answer is yes, but the timetable becomes the concern. That is to say it may take them far longer.

Mr. GORE. How much longer?

Mr. BRYEN. I do not want to put a time on it, because I do not know the answer myself.

Mr. GORE. What would be the range? I am just trying to get the facts upon which you are basing your point of view. What do you suppose that range would be?

Mr. BRYEN. Well, this would depend on how you sorted it out. If you thought that they would build turbines and compressor units independently of the General Electric design, it would take a number of years, I would think, to have a comparable system. There is another type of—

Mr. GORE. Let us assume that the patent restriction does not exist. In the absence of a patent restriction—

Mr. BRYEN. Well, then they have the capability today to build the compressor, but not the—

Mr. GORE. So there would be no effect on the timetable?

Mr. BRYEN. But they do not have the capability to build the rotors. There are two rotors in the General Electric turbine. There is some confusion on terminology. The turbine drives the compressor itself. The compressor is not really the issue, it is the turbine that drives it. There are two rotors in the compressor, and there is only one outlet in Europe that manufactures that under license today, and very low level. They make a very few. So that the issue would be could they step up the production, and I do not know how long it would take them to have the sufficient production to produce the rotors if the licensing issue was not an issue.

Mr. GORE. Well, what is your operative assumption? What would you assume that range to be?

Mr. BRYEN. I would say—this is guesswork, and only guesswork.

Mr. GORE. Yes.

Mr. BRYEN. That you are somewhere in the range of 2 to 5 years.

Mr. GORE. Two to 5 years?

Mr. BRYEN. Yes.

Mr. GORE. What we are talking about in the absence of a multi-lateral response—

Mr. BRYEN. Maybe I should amplify another point. It would also require probably a renegotiation of the contracts, because there would be a tremendous investment involved in setting up the facilities to do that. It would have to be factored into the price of the units. So it is not so simple of can you physically build it, but it is a question of how do you refinance the deal and find the support to go ahead and make those kind of investments.

Mr. GORE. What we are talking about in the absence of a multi-lateral agreement and in the absence of patent restrictions is essentially one item, the turbine in the compressor or the turbine that is already built but not in sufficient quantities. Now, I do not know how to evaluate your assumption that that might delay the thing for 2 to 5 years. But I am glad to have it on the record, because what we are after is—

Mr. BRYEN. There is a lot of guesswork in this. There has to be, because it is not the normal way things happen, and again I would emphasize that it would still require substantial additional financing to figure out how to pay for it, because it is not something that is commonly done today.

Mr. GORE. You have no reason to believe that that financing would not be available, do you?

Mr. BRYEN. It again impinges on this whole project. You have to go out and find that financing. It adds to the cost of the project. There is a delay factor involved in any event, whether it is 2 years

or 5 years or whatever it is. So it begins to call into question the viability of the whole enterprise.

Mr. WALKER. Would you yield for a moment, Mr. Chairman?

Mr. GORE. Be glad to.

Mr. WALKER. On that point, do I understand it would then become a question of whether or not there would be businesses willing to gear up and produce, for instance, the rotors for the turbine for just this one project alone if they did not feel that there were aftermarkets where they would come in competition with the United States again because it would be a non-Soviet-related kind of enterprise. Is that part of the reason why you are saying that the financing becomes crucial?

Mr. BRYEN. That is part of the reason for sure. The thing I am also wondering about is that such companies would be manufacturing a product which most of them do not have authorization to do. That is to say that this product belongs to General Electric Co., and would they do that, and then also have other corporate problems with General Electric. You know, many of these have more than just this one turbine. They make other things under license as well, so they would have to consider their relations.

Mr. WALKER. You are saying that there could be long-term harm to their relationships with other U.S. licenses?

Mr. BRYEN. Sure. And the other aspect is that these things are not exactly the most popular items in the world to make. I suspect it would be close to but not necessarily almost a one-shot proposition. These units are not in great demand.

Mr. WALKER. Thank you.

Mr. GORE. Do you favor a grain embargo, Dr. Bryen?

Mr. BRYEN. I am trying to think of an elegant way of ducking that question.

Mr. GORE. Well—

Mr. BRYEN. I will keep thinking about it. I am going to keep thinking about it.

Mr. GORE. Well, that was pretty elegant. A shorter and simpler response would be yes.

Mr. BRYEN. I did not say that, sir.

Mr. GORE. Now, you say that Soviet dependence on the West in gas production will increase in the future. What evidence do you have to support that assertion?

Mr. BRYEN. Soviet dependence on the West in gas production?

Mr. GORE. Yes.

Mr. BRYEN. For technology. I believe that—let me check my own statement. I do not think I phrased it quite that way.

Mr. GORE. At the top of page 3,

... given the crucial importance of increased gas production and gas exports to the short- and medium-term Soviet energy future, there is reason to believe that such dependence will increase.

I guess that refers to—

Mr. BRYEN. I am quoting you, your OTA study, I think.

Mr. GORE. Well, but the—what are you referencing there?

Mr. BRYEN. Well, we are referencing again the dependence on equipment and technology to support the development of Soviet energy capabilities.

Mr. GORE. All right. But that does not refer to the United States at all.

Mr. BRYEN. Well, it refers to the West, which we are part of—the United States is part of the West as it is commonly understood. The notion here is we believe that the Soviets cannot develop the gas and oil production and distribution infrastructure that they hope to develop by anything like the timetable that they want to develop it at without help from the West. Your study goes into some depth about how we have assisted substantially in assisting the Soviet oil production capability, especially tertiary recovery, things of that sort, oil exploration capabilities and gas pipeline capabilities. So I think the statement is accurate.

Mr. GORE. Mr. Johnston, it is fair to say, is it not, that there is still a difference of opinion within the administration on this issue?

Mr. JOHNSTON. Mr. Chairman, you know that before the President makes up his mind on something he gets conflicting advice, and I think he deserves to have that. But once he has made his decision and he has set out on a policy, it seems to me it is the obligation of the administration to follow what he says. A policy has been laid down—the United States is not going to export oil and gas equipment to the Soviet Union; that is the policy of the Government, and I think that is the end of the question.

Mr. GORE. What is the view of the State Department on the question of restricting patent licenses?

Mr. JOHNSTON. We have not been using the word patent, and I would like to sketch out the situation as I understand it. The regulations which the Commerce Department put into effect on the 30th of December forbid the export of equipment from the United States to the Soviet Union, forbid the export to the Soviet Union of goods which are outside the United States but which are covered by those same export controls, and forbid the manufacture of equipment and its export to the Soviet Union if it is made with technology which was shipped from the United States after the 30th of December. What we are talking about now is whether or not the United States ought to make it illegal for a foreign firm to use technology transferred from the United States before the 30th of December and ship the products of the technology to the Soviet Union.

There is a legal question. There is secondly a question of whether we could enforce an action of this sort. There has been a lot of dispute between us, the Canadians, and a good number of the Europeans on extraterritoriality, not just in export controls, but in anti-trust, and in regard to maritime relations. It is a sore subject. As a result of some of the actions that the United States took several years ago, both the British and the French passed blocking legislation. I think the last time I can remember it being used was in an antitrust case, when either a U.S. court or the Attorney General told some Englishmen to submit to the United States some records that existed in Great Britain. The British Government used its blocking legislation to forbid that firm from submitting the information. So this is an issue that runs along in a number of fields, and there is a question of what positions other governments would take if we took a step of that sort.

Mr. GORE. Mr. Walker?

Mr. WALKER. Thank you, Mr. Chairman.

I would like to pursue if I could, Mr. Johnston, the question raised earlier with Mr. Olmer on the consistency of the policy here with regard to frustrating the hard currency concerns of the Soviet Union, and I think that there are some very understandable kinds of policy implications in what the administration is doing on trade or on technology embargo, and there's a consistency in that, but where I see the consistency breaking down is when we get to the question of paying off the Polish debt. Dr. Bryen in his statement talks about the fact that there would have to be additional financing of the pipeline by the banks. Now it comes back to the same question that we are faced with in the Polish situation now. Have we made a decision that the Soviet Union would indeed allow Poland to default on its obligations and would not come to its rescue using its own hard currency to back up the Polish obligations?

Mr. JOHNSTON. I will have to answer the question at an angle. With regard to use of the word default, Poland has not been paying her bills as they came due for quite a long time. Back in 1981, the governments to which Poland owed debt, agreed to reschedule the debt. Obligations were due on certain dates, and we said the obligations could be postponed for a certain time. Subsequent to the proclamation of martial law in Poland, we said that we would postpone entering into another rescheduling arrangement. The old arrangement covered about 8 months of 1981. But what is going on now is that Poland has obligations that are coming due today, tomorrow, or the next day, and debts are not being paid.

You asked if the Soviet Union would allow Poland to be declared in default. I think that what the Soviet Union has done so far gives pretty good evidence. It is not the Soviet Union that would declare Poland in default, but rather it would be an American banker going to a court in the United States saying that this fellow owes me some money, has not paid, and please make a judgment. So far, the Soviet Union has not taken any action to indicate that it is going to come up with money and pay some bank to avoid obligations being overdue. It is the choice of the bank to decide whether or not it is going to the court.

Mr. WALKER. But does that not impinge on the reliability of the Eastern bloc as a trading partner, and does that not cause the Soviet Union to face up to a crisis based upon the policy that it is pursuing in Poland, and would it not be in the best interests of the United States to allow her to have to face a crisis situation based upon the decision that she has made with regard to Poland? The kind of things that we were doing in Poland to help sustain her during a period of time when those bills were coming due was based upon the fact that we saw some degree of change in Polish society. Now that that has been wiped out by a martial law policy, should we not, if we are concerned about the hard currency crisis in the Soviet Union, frustrate that to the point of making them make a determination between their ally and their own hard-currency concern? Is that not a legitimate kind of policy for the United States to be pursuing, given the circumstances?

Mr. JOHNSTON. Well, what the Soviets have done by not paying the Polish debt is to tear apart what used to be called the umbrella

theory. A great number of the loans made by Western and American banks to Poland, Romania, Hungary, et cetera, were made on the proposition that the Soviet Union has always paid her debts, and that rather than seeing a member of the Communist camp default on debts, the Soviet Union would pay them. Well, the Soviet Union has not paid those debts, and the umbrella theory has gone down the drain. As a result, I think the banks are more cautious than before in lending to these allies of the Soviet Union.

Mr. WALKER. Well, they are not so cautious that they are not talking about coming up with \$10 billion to \$15 billion more in financing for the pipeline.

Mr. JOHNSTON. Those credits are guaranteed by governments.

Mr. WALKER. But would not those governments begin to have questions if all of a sudden the policy were that if it is not paid up we go to court and declare you in default?

Mr. JOHNSTON. Well, the question on a Polish default is, do we want to try to get the money, or do we not want to try to get the money? If we go to court and declare a default, what are we going to have the court seize? We will have effectively given up the prospect of asking the Poles for the money. We will have recognized that Poland is in a bankrupt situation. That is of no good to the taxpayers of the United States.

Mr. WALKER. Well, except that the taxpayers of the United States are getting docked for the amount of money that we are having to pay to the banks anyhow. And the taxpayer is going to get it either way, it appears.

Mr. JOHNSTON. That is because of the way we work our CCC credit guarantees.

Mr. WALKER. That is on the floor today.

Mr. JOHNSTON. That is right. My boss is in a hearing devoted exactly to this subject. The U.S. Government has not been making direct CCC loans for the last couple of years, but what we have been willing to do is to guarantee private bank loans in order to sell our grains. The United States, since it has a given guarantee, has an obligation to pay off the bankers if the bankers are not paid by the debtors. Poland was not paying. We had an obligation to pay those banks. The question is, the issue is, do we improve the American possibilities of collecting that money by trying to declare Poland in default, and we do not think we do.

Mr. WALKER. Again it comes back to the question of what it is that we are trying to achieve out of all of this. It seems that the one thing we keep hearing that we are trying to achieve and that the OTA study backs up is the fact that we are trying to frustrate the Soviet Union based upon one of her chief Achilles heels, and that is the fact that she has hard currency problems.

Insofar as we are able to do that with the present crisis, which they brought on themselves, it seems to me that it is a reasonable policy to suggest that we ought to be in the business of frustrating that by forcing the Soviet Union to make that determination between her own allies and her own internal financial problems. We are facing those tough decisions right here.

Much of this discussion has been about the internal Western alliance and the problems we have to face when making those kinds of decisions. Why are we not forcing the Soviet Union to make those

kinds of decisions? Why are we not forcing Romania and some of the rest of the people to take a look at whether or not they consider the Soviet Union to be a reliable partner based on what she has forced on Poland? Because it seems to me that all of that is involved in this too, and that with the present policy that we are not being consistent.

Mr. JOHNSTON. But you have to look at the instruments that lie in the hands of the U.S. Government. The U.S. Government does not have an instrument to cause the Soviet Union to go into default. The Soviet Union has not reneged on her obligations.

Mr. WALKER. We do have an instrument, though, to cause Poland to go into default.

Mr. JOHNSTON. That is correct.

Mr. WALKER. Incumbent upon that it seems to me is the fact that everybody perceives the Soviet Union as not fulfilling her obligations to her allies.

Mr. JOHNSTON. She has failed to fulfill her obligations to her allies. She has not paid those debts as they came due. If you throw Poland into default, you are not going to change that. The Soviet Union is not going to pay those debts, and we will have given up the possibility of collecting the money that is owed to the U.S. Government. We do not think that is a clever idea.

Mr. WALKER. Except that we are also facing the possibility that in the future more of this money is going to go out of the United States. More banks are going to have those kinds of obligations. That is what Dr. Bryen seems to be saying in his statement, that we are going to have even more of that based upon this very pipeline, that Western bankers are prepared to come up with \$10 billion to \$15 billion more. And that the situation is going to become even tougher for us in the future, that there are going to be even more obligations out there. Is it not time we begin to feature the fact that the Soviet Union is not reliable?

Mr. JOHNSTON. The Soviet Union has done that herself. She is not paying off those Polish obligations. I think throwing Poland into default does not accomplish the goal that you are trying to accomplish.

Mr. GORE. If the gentleman will yield, I want to return to this debate, but Mr. Denysyk has an obligation to testify before the Foreign Relations Subcommittee, and I wondered if you had any questions for him.

Mr. WALKER. I have no questions.

Mr. GORE. Let me ask you to confirm the facts of the Caterpillar transaction, that on December 9, the export license was granted, and the reason that it never went into effect and was canceled by the President's actions on December 29 and 30 was that it was still being processed, and that even though the license was granted on December 9, it had not been formally signed by the end of the year.

Mr. DENYSYK. That is in essence correct. We were processing the license up until the day of the sanctions, and since it was not issued prior to the sanctions, we returned the request to Caterpillar, as we returned every other request that we had at Commerce at that time.

Mr. GORE. Thank you, and we appreciate your testimony.

Mr. DENYSYK. I can go now?

Mr. GORE. Yes. Thank you very much.

Mr. Walker.

Mr. WALKER. Earlier we asked Mr. Olmer where our friends and allies were on the issue, and he basically ducked it. Can either of you enlighten us more than he did on it?

Mr. JOHNSTON. What we have gotten from most of the allies, and I cannot give you the list, is an assurance that they will not undercut us in the sanctions that we are taking. The question is what that means, and it is in the definition of that where we begin to get foggy. I cannot say anything very precise on that, but I would like to draw your attention to a parallel. When the United States put sanctions on Iran into effect back in November 1979, we again took economic measures—Economic measures seem to be a proclivity of the United States. Other people do not do it as much as we do, but we do quite a lot of it. We tried to get cooperation from the allies.

That cooperation was slow in coming, but by May 1980—that was after 5 months—we had an agreement with the members of the European Community whereby they stopped the shipment of all goods that were not covered under existing contracts. That was an accomplishment. It took quite a lot of negotiating, and if we had been giving you status reports as it went along, sometimes it would not have looked so good. We are a little bit in that situation right now.

Mr. WALKER. When I come down to the bottom line, I guess my real question with regard to that and with regard to the previous question is how are we going to attempt to squeeze the Soviets on trade restrictions and at the same time not attempt to stop the Western governments and Western bankers from providing huge new hard currency credits to the Soviet Union? In other words, you know, where do we get some consistency in all of this?

Mr. JOHNSTON. Well, the consistency is that the United States makes a consistent effort. The lack of consistency comes when we do not get all the effects right away that we want from our efforts. I think that is what you are referring to.

As I said, the United States has traditionally been more inclined to engage in economic warfare than other countries. Since the Second World War we have had fairly extensive trade embargoes with Cuba, Vietnam, North Korea, Cambodia, Uganda, South Africa, Angola, the Soviet Union, China, Afghanistan, and Rhodesia. Now, we have done this under several administrations—

Mr. WALKER. Often because the Congress demanded it.

Mr. JOHNSTON. Well, I remember in the last administration when somebody came up with the idea that Idi Amin was misbehaving worse than usual, legislation to embargo Uganda steamed through the Congress. The administration finally came to the conclusion that it would not oppose the embargo because it was useless.

This is a phenomenon of American life. When we are engaged in looking at a situation that we do not like, in some sense the debate focuses on economic measures. If the United States does not take economic measures, it does not speak. That is the language in which the United States speaks. I think that is a phenomenon we have to recognize, but at the same time you have to recognize that there are many other countries that do not speak in that language nearly so much as we do.

That is the problem we now have. We have taken some economic measures. We are seeking cooperation with the allies. We have not gotten as much as we would like. We want to continue to work on that.

Mr. WALKER. But it seems to me it is somewhat schizophrenic to squeeze the Soviets as an official policy and then turn our backs on our friends and allies while they do business as usual. It is a question of business as usual versus not doing business as usual. Is your testimony the fact that only in this country when we see a situation like this that we reject business as usual, or that we reject business as usual as the option and everybody else says that is the way other things go, let us go on with business?

Mr. JOHNSTON. I think there is much less of a tendency for other countries to use economic warfare than there is for the United States. But when the President adopts a policy, it is then the obligation of the U.S. Government to make that policy coherent. In a case like this, the policy cannot be very coherent unless we get cooperation from the allies. That is what we are seeking.

Mr. WALKER. Would it make the point to rather than us shoring up the present Polish situation with our money, to allow them to default and make that point to all of our Western allies, that business as usual carries with it some risks?

Mr. JOHNSTON. Well, I do not know what you mean by shoring up the Polish economy. We are not doing that. In any definition of what we are doing, we are not shoring up the Polish economy. We had obligations to pay American banks if they were not paid by the Government of Poland. We cannot just say we refuse to honor those obligations. Those obligations have the—I hate to use the words—full faith and credit of the United States. We are not paying Poland.

Mr. WALKER. Why do we not call in the debt? I admit that what we are doing is the fact that we are refinancing the debt for a long period of time, but given the present circumstances, why do we not just call it in? That is my point.

Mr. JOHNSTON. If we call in that debt and we try to declare Poland in default, we will not get anything out of Poland. What we want is to be paid off. If we put Poland into default, we would be doing the same thing as you recognize when a fellow goes into bankruptcy that is, that you don't have much prospect of getting anything from him. Poland owes debts in total of something close to \$27 billion. Now, what can any country do to put its hands on Poland's assets? There are a couple of Polish ships running around the ocean. Is it worth it to us to declare Poland in default and seize those ships—which may be worth who knows what, but not a very large portion of that debt—and give up the prospect of being paid the debts that are owed to us? We do not think so.

Mr. WALKER. It seems to me that it does leave the very clear idea then that has obviously not been a clear idea insofar as our allies are concerned that indeed there are risks in business as usual with an adversary such as the Soviet Union.

Mr. Olmer says in his prepared statement:

This administration remains deeply apprehensive about the security implications of accelerated East-West economic and political integration. We believe that over the past 10 years the free world has concentrated its attention on the Soviet mili-

tary threat while remaining largely oblivious to the Soviet economic threat. We have failed to appreciate that under conditions of relative strategic equivalency that the economic aspects of East-West relationship may be a divisive factor.

I think that is right, and I wish there seemed to be a greater commitment to do something concrete when there is a crisis immediately before us.

Mr. JOHNSTON. I hate to use the analogy of shooting oneself in the foot, but if you want to make a gesture whereby you give up the prospect of being paid the debts that you are owed, that is something you can do.

Mr. WALKER. Is there any hope we will ever be paid the debts?

Mr. JOHNSTON. We have been owed debts by countries before. As long as the martial law system exists as it is, there is of course, little hope. But we want to continue to have the prospect of being paid. If we are paid, it will be in a very long time.

Mr. WALKER. But you see what the martial law thing tells me is the fact that there will never be anything but martial law. Regardless of how free it becomes, the Soviet Union will come back and crack down again. We have decided in 1982 to allow the situation to just go on a little bit further.

Thank you, Mr. Chairman.

Mr. GORE. Following along the same line, is it true that the State Department is still financing a cooperative venture with the Soviet Union to develop computer applications in physics at the Institute of Applied Physics in Vienna?

Mr. JOHNSTON. I have not the foggiest idea. That is something I never heard of. I will have to furnish you that information.

Mr. GORE. If you could, I would appreciate it. Again, consistency is not everything, but it does have some significance.

[The information follows:]

Congressman Gore refers to U.S. Government participation in the International Institute for Applied Systems Analysis which is located in Vienna. The United States is currently one of 17 governments which participate in this organization. The National Science Foundation, not the State Department, has funded U.S. participation.

In November of last year, we informed the Institute that the United States will withdraw from this organization effective at the end of calendar year 1982. We would have withdrawn from the organization last November, but the Institute's charter stipulates that that member countries must submit a notice to withdraw 12 months in advance of actual withdrawal.

Mr. JOHNSTON. The oil and gas measure was by no means the sole one, which the President announced on the 29th of December. One of the things he announced was that we were going to terminate as rapidly as we could agreements on cooperation in science and technology that we had with the Soviet Union.

Mr. GORE. Now, your testimony also states that—well, let me ask you this first. Which countries have declined to join us in the sanctions against the technology for the pipeline?

Mr. JOHNSTON. Well, I can't say there is anybody that has really committed himself in the ironclad way that we would like.

Mr. GORE. So nobody's agreed?

Mr. JOHNSTON. What I am trying to say is that we have a general commitment from the allies that they will not undercut us. Now the question is to define that phrase so it will have some meaning.

Mr. GORE. But nobody has accepted our definition on it?

Mr. JOHNSTON. We are still working on it.

Mr. GORE. So the answer is that none of our allies have agreed to what we would like them to agree to; is that correct?

Mr. JOHNSTON. Well, I think that we will find the answer to that when a specific case comes up.

Mr. GORE. But the answer is that as of the present time, none of them have agreed to do what we have asked them to?

Mr. JOHNSTON. They have said to us that we will not undercut our sanctions.

Mr. GORE. Did not we ask them for more than just a general statement?

Mr. JOHNSTON. We asked for parallel action and none of them have taken any exactly parallel action.

Mr. GORE. None of them have taken action or agreed to do so?

Mr. JOHNSTON. Well, they have taken action but not in the field of energy.

Mr. GORE. Not anything that relates to the pipeline?

Mr. JOHNSTON. That is right.

Mr. GORE. Well, how are we going to make our policy work if none of the other countries have agreed to go along with us?

Mr. JOHNSTON. As I told you, this takes time.

Mr. GORE. Well, it may take an awful long time. What reason do you have to believe that at the end of a lengthy period of time it will be successful?

Mr. JOHNSTON. I cited the example of Iran and I think that situation is very instructive in these circumstances. We went to the allies in January of 1980 and we asked that they take precisely the same measures that we were taking toward Iran. It took us until May, but we got something then.

And the point is that if we want to have any effect in this field, we have got to have a consistent policy so far as the allies are concerned. That is worth working for.

Mr. GORE. Well, you also state that we are still trying to convince the Europeans about the pitfalls of dependency associated with the pipeline.

How do you assess the likelihood that later this year that the French and the Germans and the Italians will send a letter to the State Department and say, "You finally convinced us. We have decided this is a bad idea for us. We are going to cancel our contracts and pull out of this thing because we don't want to be dependent on the Soviet Union. We want LNG from Algeria instead."?

Mr. JOHNSTON. Well, it is a rough road, there is no question about it.

Mr. GORE. Would you assess the chances of that as zero?

Mr. JOHNSTON. No, I would not say zero.

Mr. GORE. What chances would you say there is of that happening?

Mr. JOHNSTON. I am not very good at numbers like that but I must admit it is a hard job.

Mr. GORE. But wait a minute. You think it is possible, though. You think it is possible that the Germans and the French and the Italians later this year will come to the United States and say, gee, it just took us a little while to realize it but we were wrong?

Mr. JOHNSTON. That is not the way I would look at the scenario. I can see that there might be some essential things that needed to be done on the pipeline and that some country refused to do it. No, I don't see anything—

Mr. GORE. No, my question is your testimony on our effort to convince the Europeans that they should not do this?

Mr. JOHNSTON. Well, I will say that because of what the United States has done and because of the conversations that we have had with the Europeans, they have certainly begun to recognize the dangers much more than they did before.

For example, the French have decided that they are going to have bigger gas reserves than they anticipated. When they put contracts into effect for the Soviet gas, they are going to be interruptible contracts and alternative fuel will be available for factories.

There is much more interest in the European gas grid than there was before we started these conversations. So I think we have made some progress.

Mr. GORE. Well, I think those are useful accomplishments, for whatever reason they have done that but you don't really think that there is any chance, do you, of convincing the allies to change their minds about hooking into the pipeline?

Mr. JOHNSTON. I think there is enough chance so that it is worth an effort from the U.S. Government and this is an effort that we are still trying to pursue.

Mr. GORE. Do you think there is a good chance that they will decide not to hook into the pipeline?

Mr. JOHNSTON. I think there is chance enough that it is worth the effort of trying.

Mr. GORE. What do you mean by trying? What does the United States have to offer that would convince them to pull out of the agreement to hook into the pipeline?

Mr. JOHNSTON. Well, there are two things, it seems to me, that are essentially involved in the pipeline. One is the European desire to have some alternative sources of gas and the other is the European desire to sell the equipment for the pipeline.

I think that where we can do the most is in terms of trying to offer the Europeans some assurances in regard to supplies of energy.

Now, we cannot do what would be really the most persuasive thing. We cannot say that we will furnish gas from the United States to Europe. However, what we can do is to take steps in the coalfield. We can also take steps in regard to showing that the United States, because of its own gas policy, is not going to be in the LNG markets of the world.

We can take steps to persuade other countries which have the potential of making LNG available to Europe that they should do that. There are a number of those kinds of steps that we can take.

Mr. GORE. And you think the combination of those steps may convince Germans and French and Italians to change their current stance and decide to pull out of the pipeline?

Mr. JOHNSTON. It is worth pursuing.

Mr. GORE. Well, I guess some people would argue that that is an unrealistic quest.

In your statement, Dr. Bryen, you say that our Western allies have had "a slower reading of the changing international energy scene."

Are you suggesting that the Germans and French don't know what they are doing or that—

Mr. BRYEN. I don't think I am suggesting that they don't know what they are doing, sir. I think that what has happened here is that a certain project, the West Siberian pipeline, has become a very strong and substantial effort and it has tended to make other possibilities, not all other but other possibilities, they have received less attention and we think that that is unfortunate that some of the other possibilities ought to receive attention.

There is, for example, substantial natural gas reserves in Norway, which is nearby. There are still reserves in Holland and elsewhere, Algeria to name some, Nigeria, some of the Persian Gulf States, even as far away as Mexico that could supply gas.

We get to the problem of financing and if you build this pipeline and commit, I don't know, \$10 or \$15 billion to it, then I would suspect that the financing for other alternatives will not be available, at least not in the foreseeable future given the demand curves that we anticipate.

So, what you basically say to the other free world countries, we are not going to invest here because we are going to invest in a project with the Soviet Union.

Our preference is to have the investment in the free world.

Mr. GORE. Well, I want to thank both of you for coming here today. It has been our effort to try to enhance the debate and try to get some agreement on the basic facts which are underlying the debate and I hope that we have played a constructive role.

We will maintain our interest in this area and, again, I would like to commend the Office of Technology Assessment for the really superb work that people on all sides of these questions have found to be extremely useful. And I, again, thank you as witnesses.

[Whereupon, at 12:20 p.m., the subcommittee was adjourned.]

